



United States
Department of
Agriculture

Forest
Service

Angeles National Forest
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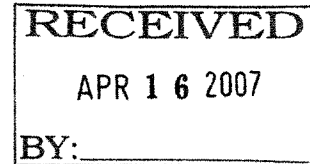
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File Code: 1900

Date: April 11, 2007

Mehdi Morshed
Executive Director
California High-Speed Rail Authority
Attn: Carrie Pourvahidi
925 L Street, Suite 1425
Sacramento, CA 95814



Dear Mr. Morshed:

We have reviewed your Notice of Preparation for a Project Level EIR/EIS for the proposed section of the California High-Speed Train (HST) system from the City of Palmdale to the City of Los Angeles, and offer the following comments regarding the development of the scope of this environmental analysis, potential impacts, and significant issues. Our comments include specific suggestions for development of alternatives and mitigation measures to address our concerns.

Some of the environmental issues we include here were identified at a programmatic level in the Mitigation, Monitoring, and Reporting Plan for the California High-Speed Rail Program EIR/EIS. These will need to be addressed at a site-specific level when considering proposed alignments and design for the Palmdale-to-Los-Angeles segment.

1) Wildlife Connectivity

The proposed alignment for the Palmdale-to-Los-Angeles segment will generally parallel Interstate 14 through Soledad Canyon. While the alignment may not be on National Forest System land, it will certainly bisect key wildlife linkages between the two major portions of the Angeles National Forest. We request that Wildlife Connectivity be specifically identified as one of the Key Issues addressed in the EIR/EIS.

We also request that the EIR/EIS analysis consider the findings in the research and studies concerning connectivity we reference below and/or have attached, as you develop the project design and mitigation measures. It is possible at this stage of the planning process, with this wealth of research readily available, to identify site-specific impacts and incorporate analysis of state-of-the-art wildlife corridors into development of the EIR/EIS alternatives, to allow for maintenance of biodiversity and wildlife movement across the landscape.

We request that the analysis consider cumulative effects from other developments in Soledad Canyon (freeways, railways, power transmission lines, etc.). We ask that alternatives be developed and analyzed that look at ways to actually improve wildlife movement, by removing barriers that may have been caused by these developments. We are aware of state-of-the-art wildlife corridors that have been constructed in other parts of the country, and ask that these be considered in the upfront design of the HST through Soledad Canyon.



Wildlife Connectivity Resources

The recently revised Land Management Plans for the Angeles, Los Padres, Cleveland, and San Bernardino National Forests (2005) identified maintenance and restoration of habitat linkages between southern California's national forests and other open space reserves as a key management challenge in this highly urbanized region. All four Forest Plans identify maintaining an interconnected network of undeveloped areas of landscape linkages as a priority goal. The *Angeles National Forest Land Management Plan* includes program strategies for habitat linkage planning that should be considered in developing alternatives and mitigations for this project. We have included a CD copy of the Land Management Plans and several hard-copy excerpts, for your convenience.

The Southern California Mountains and Foothills Assessment (USDA Forest Service, 1999), a comprehensive collection of research about key issues affecting the ecological integrity of this region, describes Soledad Canyon, with its key wildland linkage, as being an area of high ecological significance. This document is available online at www.fs.fed.us/psw/publications/documents/gtr-172/

The Forest Service is a partner in a consortium of groups and agencies that jointly identified more than 300 wildlife linkages throughout California that are vital habitat linkages for species diversity. In their report, *The South Coast Missing Linkages Project: A Linkage Design for the San Gabriel-Castaic Connection*, they studied and developed a linkage design for a wildlife connection through Soledad Canyon. This project, which includes considerable site-specific analysis, can be viewed on the internet at www.scwildlands.org/reports/SCML_SanGabriel_Castaic.pdf

The Forest Service and other stakeholders partnered with The Nature Conservancy in developing the *Santa Clara River – Upper Watershed Conservation Plan*. The study area includes Soledad Canyon. This analysis, which includes research on wildlife linkages in the area, can be viewed online at www.santaclarariverparkway.org/wkb/scrbiblio/tnc2006

We also recommend the book, *Ecosystem Management: Adaptive, Community-Based Conservation* (pp. 193-209), as a good resource on designing effective wildlife corridors.

In addition to these resources, Forest Service biologists are available to answer questions you may have concerning wildlife movement in and through Soledad Canyon (see contact information below).

2) Cultural Resources

Large prehistoric sites exist in the Acton-Agua Dulce area, such as at Vasquez Rocks. Soledad Canyon, the area of the first American gold rush, also contains many historic sites. Any alternatives considering below-grade development will need to analyze impacts from large amounts of ground disturbance in this heritage-rich area.

3) Recreation Resources: Pacific Crest Trail

The Pacific Crest National Scenic Trail, "the jewel in the crown of America's scenic trails," crosses Soledad Canyon and will be crossed by any HST alignment alternative through the canyon. Impacts to the use and enjoyment of the trail will be a site-specific issue. As with the wildlife corridor issue, alternatives will need to analyze these impacts and consider passage corridor designs and mitigations that respond to the impacts.

The *Angeles NF Land Management Plan*, in its description of program emphasis in the Soledad Canyon area, states that special emphasis will be given to acquiring private land between the San Gabriel, Castaic, and Sierra Pelona Mountain Ranges in order to connect the Pacific Crest Trail. We request that the Land Management Plan's analysis and strategies be considered in analysis of HST impacts and alternatives.

Information about the trail is available online at www.fs.fed.us/pct/. Recreation specialists on the Angeles National Forest are also available to answer questions about the trail segment in Soledad Canyon.

4) HST Alignment on National Forest System Lands

The final alignment through Soledad Canyon may shift laterally as much as a mile, meaning that there is a possibility that it could cross National Forest System lands. If any alternative proposes crossing the Angeles National Forest, the analysis will need to consider all administrative, ownership, and legal impacts and requirements, in addition to the environmental issues currently listed in the scoping materials for this project. We recommend that you contact our office for specific information regarding analysis considerations in the event that you develop such an alternative.

5) Air Quality

We assume that the general conformity determination (a Clean Air Act requirement) for the HST analysis will disclose direct air quality effects. Our concern would be that long-term, indirect, and cumulative effects to air quality also be considered and analyzed in the alternatives. Such impacts would be from build-out and transport corridor expansion resulting from this convenient new mode of transportation in a rapidly urbanizing area.

The EIS for the Angeles NF Land Management Plan addressed air quality conditions in and around the Forest, and found that current ozone concentrations in urban areas near the four southern California national forests exceed (do not meet) the National Ambient Air Quality Standards (NAAQS). This implies that nearby areas within the national forests might also be considered unhealthy for people because of ozone concentrations. Forest vegetation exposures to ozone are causing growth reductions in sensitive plant species on the national forests and could cause these species to become less abundant, or in some cases sensitive genotypes might totally disappear from the national forests (Final EIS Vol. 1, p. 221). We request that the *Angeles NF Land Management Plan's* analysis of air quality conditions in the Final EIS be considered in analysis of HST impacts and alternatives.

We also request that the analysis consider other air pollutants, such as nitrogen pollutants, and the impacts that increased concentrations of these might have on nearby forest ecosystems.

6) Aesthetics and Visual Resources

The Soledad Front Country Place of the Angeles National Forest runs northeast to southwest along both sides of Interstate 14 along the Santa Clara and Soledad Rivers. This Place functions as a scenic backdrop for residents of communities in the area, who have the scenic views of the San Gabriel Mountains from their homes and travel corridors. We request that the EIR/EIS analysis consider impacts (both direct and cumulative) of the HST on this visual resource.

Visual impacts will be particularly noticeable for any alignment alternative that is located between existing railroad tracks and the national forest.

7) Noise

Noise and startle effects on wildlife, particularly riparian birds, needs to be considered in project impacts. This will also affect wildlife movement and the wildlife connectivity issue. Forest Service biologists are available to discuss this with the HST interdisciplinary team preparing the EIR/EIS.

8) Wildfire Fire Risk

Any analysis of a proposed project in or adjacent to the Angeles National Forest (the wildland urban interface, or WUI) needs to consider the issue of wildfire risk and community protection. The Angeles National Forest Land Management Plan identifies wildfire as one of the biggest challenges forest managers and the public currently face. Residents of Soledad Canyon are very much aware of fire danger in the surrounding area and the threat that wildfire poses to their communities. We request that the EIR/EIS include an analysis of fire risk associated with the construction, use, and maintenance of the HST.

We appreciate the opportunity to comment on this proposal. Thank you for including our suggestions and recommendations as you design the scope of this very significant project. Please contact Kathy Peterson, Acting Forest Planner, if you have questions regarding our comments (phone: 626-574-5206; e-mail: kjpeterson@fs.fed.us) or if you need further information.

Sincerely,


JODY NOIRON
Forest Supervisor

Enclosures



United States Department
of Agriculture

Forest Service

Pacific Southwest Region

R5-MB-075

September 2005



Land Management Plan

Part 1 Southern California National Forests Vision

Angeles National Forest

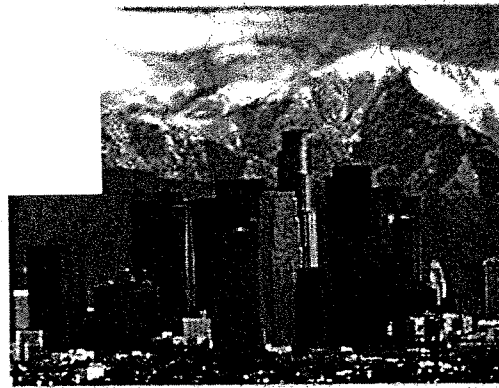
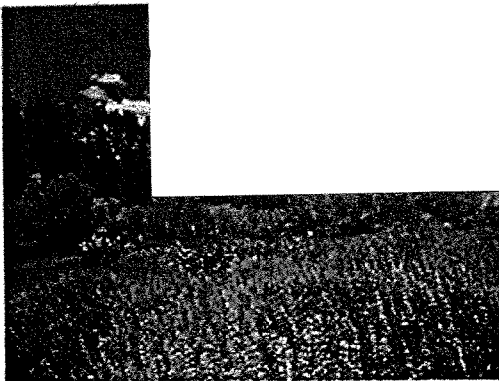
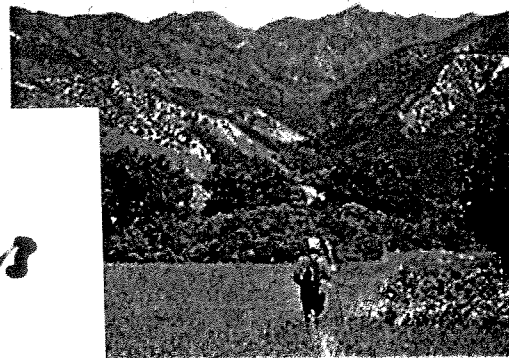
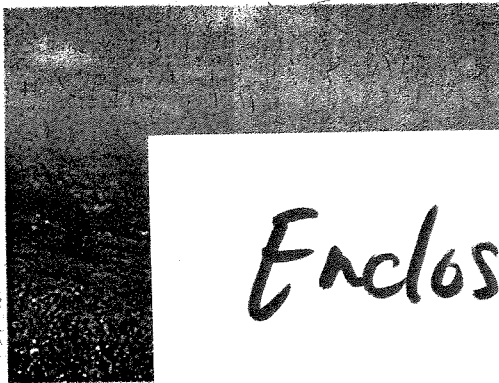
Cleveland National Forest

Los Padres National Forest

San Bernardino National Forest

Excerpts

Enclosures



Introduction

The revised land and resource management plans (forest plans) for the southern California national forests describe the strategic direction at the broad program-level for managing the land and its resources over the next 10 to 15 years. The strategic direction was developed by an interdisciplinary planning team working with forest staff using extensive public involvement and the best science available. The revised forest plans have a focus that is different from the old forest plans. The revised forest plans are outcome based and are focused on the condition of the land after project completion rather than the products removed from the land. Each forest plan is directed toward the realization of the desired conditions using strategies that are consistent with the concept of adaptive management and sustainable resource use.

The revised forest plans are grounded on the concepts described by the Committee of Scientists in their report, *Sustaining the People's Lands* (Committee of Scientists, March, 1999). Paraphrasing the committee's report, the term sustainability includes three components: ecological, social, and economic. Sustainability means meeting the needs of the present generation without compromising the ability of future generations to meet their needs. The concept of sustainability is old; its broadened interpretation and redefinition should be viewed as a continuation of the attempt by Gifford Pinchot and others that followed him to articulate the meaning of 'conservation' and 'conservative use' of the lands and waters of the national forests. Therefore, the revised forest plans are designed so that managers have the flexibility to adapt management strategies to the constantly changing demands that are inherent to natural resource management. The strategic direction is expressed through an overall vision of what is wanted, the strategy for accomplishment, and the design criteria that will be used as activities are proposed, analyzed and implemented.

The forest plans were prepared according to the requirements of the National Forest Management Act (NFMA), the National Environmental Policy Act (NEPA), and other laws and regulations (Appendix A). The current forest plans for the southern California national forests were approved between 1986 and 1989. NFMA regulations require that each forest plan be revised every 10 to 15 years (36 CFR 219.10). The revised forest plans have been prepared to meet that requirement.

The forest plans were developed to implement Alternative 4a (selected). Alternative 4a (selected) represents the adjustment of the preferred alternatives identified in the draft environmental documents. The accompanying Final Environmental Impact Statement (FEIS), describes the analysis used in formulating the revised forest plans.

Organization of the Forest Plan

This forest plan presents a new format based on a model that is referenced in FSM 1921.1 and further described in FSH 1909.12, Chapter 10, section 12.2 Plan Components. The format consists of three interrelated parts that work together to facilitate the use of adaptive management and the development of management activities that will collectively move the national forests toward their desired outcome. Part 1 paints the picture of the vision and conditions desired in the long-term. Parts 2 and 3 contain, respectively, the strategic management direction and the guidance for designing actions and activities in order to make progress toward the vision and desired conditions described in Part 1. The contents of the forest plan are organized as follows:

Part 1 is the vision for the southern California national forests. It describes the national forests' uniqueness on a national and regional level. It describes the Forest Service's national goals, the roles and contributions that the national forests make (their niche), the desired conditions (36 CFR 219.11(b)) for the various landscapes within the national forests, and finally, the evaluation/monitoring indicators (36 CFR 219.11 (d)) that will be used to assess the progress made toward accomplishing the desired conditions. The Code of Federal Regulations (CFRs) is the implementing regulations for laws. Part 1 includes:

- **Niche:** Distinctive roles and contribution of the national forests. The vision document begins with a description of the national forest, including its distinctive roles and contributions to the local area, state, region, and nation. Through the course of public collaboration, the niche for National Forest System lands has been identified.
- **Government Performance and Results Act (GPRA) goals:** (36 CFR 219.12 (f)(6)): In 1993, Congress passed the GPRA to increase the accountability of federal agencies by measuring progress toward achieving agency goals and objectives. This legislation requires preparing periodic strategic plans. In 2003, the Forest Service (USFS 2003) issued an updated draft version of the 2000 Strategic Plan for the agency. These long-term goals and objectives help guide the Forest Service's current actions and future plans.
- **Desired Conditions:** The desired conditions describe the ecological, economic and social attributes that characterize or exemplify the outcome of land management. In short, this means how the national forests are expected to look and function in the future when the revised forest plan direction has been successfully implemented. Desired conditions can be measured now and over time through monitoring. Each national forest desired condition contributes to the achievement of GPRA goals. Desired conditions are not commitments and may be achievable only over the long-term.
- **Evaluation/Monitoring Questions:** Each of the desired conditions is linked to evaluation/monitoring questions. These questions are designed to evaluate the indicators of progress over time towards the desired conditions (outcomes). These, along with annual accomplishment indicators and implementation monitoring of design criteria constitute the land management monitoring plan (36 CFR 219.11(d) and 36 CFR 219.12(k)).

Part 2 is the strategy. The strategy describes the objectives (36 CFR 219.11 (b)) that the Forest Service intends to implement in order to move the national forests toward the vision described in Part 1. Part 2 identifies suitable uses through land use zones (36 CFR 219.11(c)) that show allowable uses and opportunities by zone, including existing and recommended wilderness and other special area designations (36 CFR 219.17). Part 2 also presents a prospectus that describes past program performance, program priorities and objectives, and a discussion of performance risks, recent trends, and expectations regarding the levels of experiences, goods, and services supplied by the national forests. The national forests have been subdivided into geographic areas called 'Places.' The theme and desired condition and the multiple-use management focus for each Place are described in Part 2.

Part 3 is the design criteria. The design criteria include the laws, the standards (36 CFR 219.11 (c) and 219.13 through 219.27) and a reference to other applicable guidance that the Forest Service uses during project planning and implementation. Standards are mandatory requirements

that come into play as site-specific activities are planned for implementation, and are designed to be consistent with achieving the objectives and desired conditions. The standards act as thresholds or constraints for management activities or practices to ensure the protection of resources.

Purpose of the Forest Plan and Adaptive Management Framework

The purpose of the revised land and resource management plan is to articulate the long-term vision and strategic management direction for each southern California national forest and to facilitate the development of management activities that will contribute toward the realization of the national forests' desired conditions. The forest plan defines the parameters (limits) for management, but offers the flexibility to adapt decisions to accommodate rapidly changing resource conditions.

A forest plan ~~makes~~^{meets} six fundamental requirements including:

- The establishment of forest-wide multiple-use goals and objectives. This requirement is met through a combination of the desired conditions described in Part 1 and the more traditional objectives described in Part 2.
- Determine the suitability and capability of national forest land for resource production. This requirement is met through the use of appropriate scientific analytical processes described in the project record, land use zoning, and the identification of land uses appropriate for the zones that are included in Tables 2.1.1 through 2.4.4 in Part 2 of the revised forest plans.
- The identification of, and recommendation to, Congress for areas as wilderness and wild and scenic rivers. This requirement is met based on the wilderness evaluations for Inventoried Roadless Areas, the suitability studies done for eight rivers, and the eligibility inventory (no decision) for an inclusive list of rivers and creeks on all four southern California national forests (36 CFR 219.17- 219.18).
- The establishment of forest-wide and forest-specific standards. This requirement is met through the simplified list of mandatory design criteria and the associated Forest Service Manual and Handbook requirements described in Appendix A of Part 3 (36 CFR 219.11(c)).
- The identification of management area prescriptions. This requirement is met through the use of land use zones that are identified on the national forest zoning map and described in Part 2 of the revised forest plans (36 CFR 219.11(c)).
- The establishment of monitoring and evaluation requirements for plan implementation. This requirement is met through the monitoring requirements identified and described in all three parts of the revised forest plan. All monitoring requirements are detailed in Appendix C of Part 3 (36 CFR 219.11(d) and 36 CFR 219.12(k)).

It is important to emphasize that the revised forest plans are completely strategic. They do not make project level decisions nor do they compel managers to implement specific actions or activities. Current uses are carried forward. Any changes made to existing uses or new proposals will be determined at the project level according to the requirements of the National Environmental Policy Act (NEPA). This concept is consistent with the requirements of the

National Forest Management Act (NFMA), and with the agency policy of two decision levels: 1) strategic, and 2) project (site specific). These strategic plans **DO NOT**:

- create, authorize, or execute any ground-disturbing activity;
- grant, withhold, or modify any permit or other legal instrument;
- subject anyone to civil or criminal liability; nor
- create legal rights.

The original forest plans were often a confusing mix of strategic and site-specific direction that have been difficult to implement. In contrast, the revised forest plans describe only the strategic direction and offer the flexibility for managers to deal with unpredictable events that range from politics and policy decisions at the national level to on-the-ground situations such as drought, disease, or wildland fire.

Managers will work from within this strategic framework as they make decisions and propose site-specific projects that are designed to incrementally move the national forests toward the desired conditions. Project decisions must be consistent with the strategic direction, or must amend the plan. Site-specific projects may be the result of public demand (i.e., utilities including hydro-electric, transportation corridors, airports or more specific requests, such as groundwater extraction), or they can result from resource program needs (i.e., vegetative management, habitat projects, roads or trails construction). Projects will, in general, be proposed for implementation in order to bridge the gap between existing and desired conditions. Detailed analysis of resource trade-offs rightfully occurs at the project level where the extent of project requirements is known and can be assessed at the appropriate scale.

At the open house in Goleta, people study maps and discuss the management alternatives in the draft EIS with Forest Service Representatives.

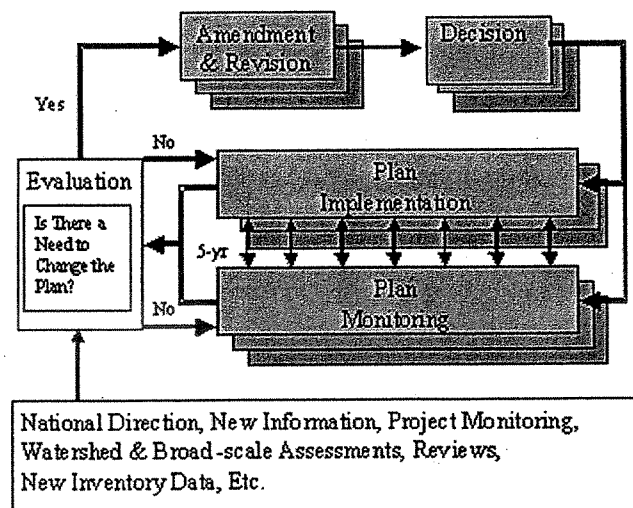


This concept would support the argument that forest plans by themselves are not action-forcing or ground disturbing with significant effects on the human environment and would not require an Environmental Impact Statement (EIS). That discussion is moot since these revisions are being done to comply with the requirements of the 1982 planning regulations including the preparation of an EIS. What is different is the level of analysis that is done to support the strategic direction described in the revised forest plans. Rather than the exhaustive, expensive analysis that has been done in the past, the Forest Service is analyzing information at the coarse scale that is more appropriate to identify trends and conditions of environmental indicators that support the

conclusions made in the EIS. Rather than projecting what might happen in the future through modeling in the EIS, the revised forest plans establish an adaptive management framework.

The revised forest plans describe the monitoring and evaluation that is the linchpin for the success of an adaptive approach to national forest management. The forest plans also identify the data that will be gathered over time and periodically evaluated to determine if changes in management are needed. Current conditions of key environmental indicators are identified in the EIS along with projected trends. Actual trends in key environmental indicators are used to measure changes over time as the basis for determining when a need for change is indicated. Monitoring is the vehicle for adapting to change and to more easily amend and eventually revise forest plans in order to achieve desired conditions while ensuring the presence of healthy thriving public forests for future generations.

Figure 1. The Three Parts of a Plan in the Adaptive Cycle



Vision, Forest Niche, and Management Challenges

General Location

The southern California national forests (Angeles, Cleveland, Los Padres and San Bernardino) include over 3.5 million acres of federally managed public land extending from Big Sur to the north and the international border with Mexico to the south

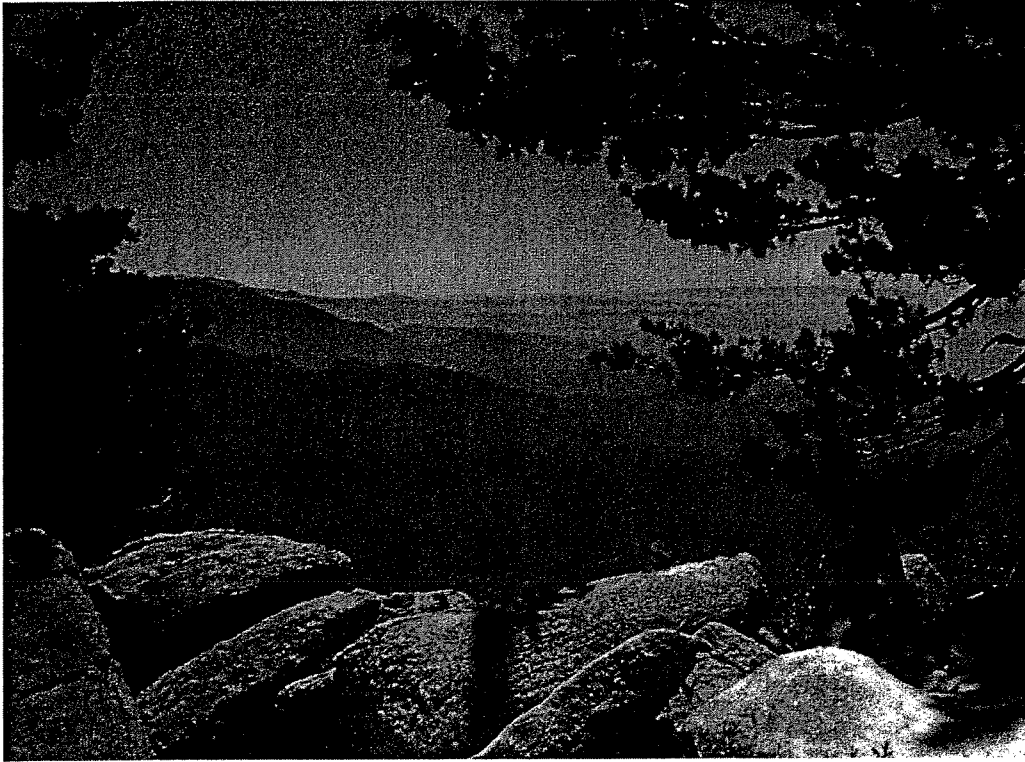
The Angeles National Forest (662,983 acres) is located within Los Angeles, San Bernardino and Ventura Counties. The Forest Supervisor's office is located in Arcadia and there are Ranger District offices in Glendora, Saugus, and Tujunga.

The Cleveland National Forest (420,877 acres) is located within Orange, Riverside and San Diego Counties. The Forest Supervisor's office is located in Rancho Bernardo and there are Ranger District offices in Alpine, Corona, and Ramona.

The Los Padres National Forest (1,781,364 acres) is located within Kern, Los Angeles, Monterey, San Luis Obispo, Santa Barbara, and Ventura Counties. The Forest Supervisor's office

is located in Goleta and there are Ranger District offices in Frazier Park, King City, Ojai, Santa Barbara, and Santa Maria.

The San Bernardino National Forest (665,753 acres) is located within San Bernardino and Riverside Counties. The Forest Supervisor's office is located in San Bernardino and there are Ranger District offices in Fawnskin, Idyllwild, Lytle Creek, Mentone, and Skyforest.



A spectacular forest vista (San Bernardino NF photo).

Vision

The southern California national forests provide a balanced and sustainable flow of goods and services for a growing diverse population while ensuring long-term ecosystem health, biological diversity, and species recovery. The national forests also accommodate changing trends in visitor use through outreach efforts, facilities and education that meet the needs of emerging population demand.

National Forest watersheds are managed to provide many benefits including flood protection and quality drinking water for downstream communities, as well as protection of Wildland/Urban Interface (WUI) areas from wildland fire. They also offer a haven for native plants and animals, and provide unique and irreplaceable habitat for threatened, endangered, and sensitive species.

The national forests offer an escape from busy urban life by providing much-needed open space and a wide variety of recreation opportunities. They serve as an outdoor classroom, a 'living laboratory,' for learning about our natural and cultural heritage and the importance of conservation.

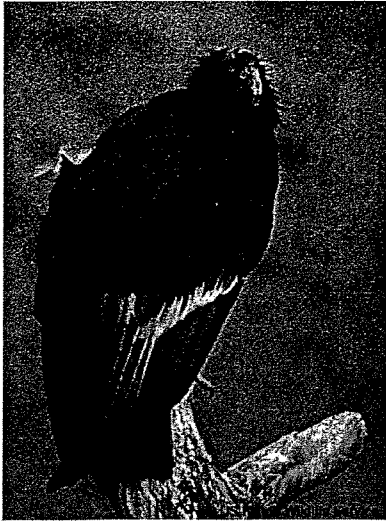
Conservation education for youngsters on the Los Padres NF.



Forest Niche

On a global and national scale, the national forests:

- constitute four of the most urban-influenced national forests in the total National Forest System (NFS). They serve as an open space, visual backdrop, recreation destination, and natural environment for a diverse, urban population of over twenty million people who live within an hour's drive of any one of the four national forests.
- lie within a region recognized by Conservation International as one of the world's 'biodiversity hotspots' (areas where exceptional concentrations of endemic species are undergoing exceptional loss of habitat). They provide habitat for 31 federally listed threatened and endangered animals, 29 federally listed threatened and endangered plants, 34 Region 5 sensitive animal species and 134 Region 5 sensitive plant species.
- provide the opportunity for scenic driving and access to National Forest Scenic Byways and Scenic Highways, including California State Highway 1, the 'All-American Road.'
- continue to provide a high-quality recreation setting for a large portion of the Pacific Crest National Scenic Trail (over 400 miles) and several National Recreation Trails, as well as three designated Wild and Scenic Rivers.
- manage 69 National Register of Historic Places sites, 13 State Historic Landmarks, and over 400 sites that are eligible to be included in the National Register.
- manage 21 nationally designated wildernesses, which cover approximately 1.1 million acres of NFS land.
- cooperatively manage a large portion of the Santa Rosa and San Jacinto Mountains as a national monument.



Approximately 3000 species, including many rare species such as the California Condor, are at home in the diverse habitat on the four national forests in southern California.

USDI Fish and Wildlife Service photograph

On a regional scale, the national forests:

- continue to offer a variety of recreation opportunities that meet the changing trends in visitor use. They provide equality in public participation in settings ranging from coastal shoreline to rugged canyon and mountain areas while meeting the needs of diverse populations, many who create new demands for the use of open space.
- play an important role in the education, outreach and development of stewardship within urban communities.
- play an important regional role in maintaining large blocks of wildland habitat. Combined with a mix of local, state, federal, and private lands, they form a regional system of open space and habitat preserves within one of the most highly urbanized landscapes in the United States.
- contain diverse habitats important to maintaining well-distributed populations of native and desired nonnative plant, fish and animal species.
- contain areas that are the only remaining habitat refugia for species imperiled by the loss or degradation of habitat off-forest.
- provide some of the only remaining available spawning habitat for stocks of southern steelhead trout.
- include areas that can be cooperatively managed with communities and other agencies for more effective wildland fire protection to reduce the threat of wildland fire and the floods that often follow wildland fires. The national forests were originally established to protect the health of watersheds from erosion damage and flooding that follow wildland fires.
- serve as quality, low-cost, local source of water consumed by the urban population of southern California. The national forests continue to serve as a recharge area for numerous reservoirs and groundwater basins that provide water for numerous communities, and for agricultural and industrial uses.

- provide opportunities for research and education in Research Natural Areas, Special Interest Areas, and the San Dimas Experimental Forest.
- provide postcard landscapes that serve as scenic backdrops for highly developed urban areas, and some of the last vestiges of vast, natural-appearing landscape panoramas.
- sustain the historic use of the national forest for urban infrastructure, considering technological advances to reduce the impacts on the natural environment in the future.

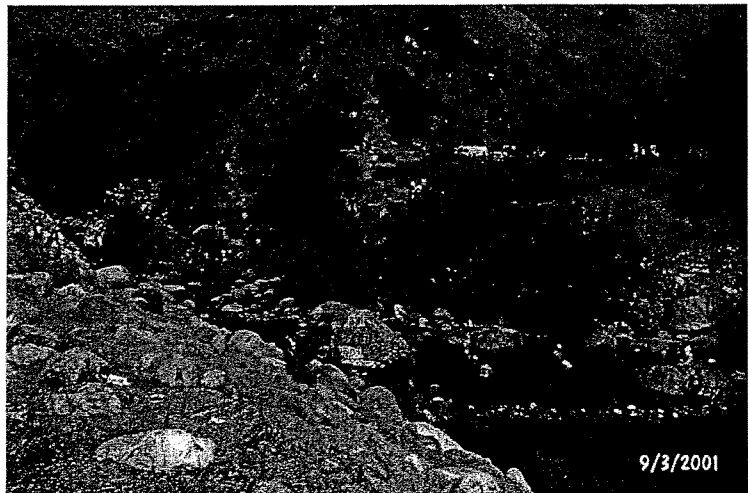
Management Challenges

Maintaining healthy, sustainable national forests in southern California is affected by a complex set of factors including population growth, rapid urbanization, recreation use, access, drought, disease, tree mortality, fire, exotic pests and invasive non-native species, and protection of natural resources. For the sake of brevity, these factors are addressed in three major categories: urbanization, fire, and natural resources. The health of the southern California national forests depends on our ability to meet these challenges, while at the same time maintaining forest and community sustainability.

Urbanization

The rapidly increasing population of southern California, and the resulting effects on the national forests is one of the main challenges the Forest Service faces. The Angeles and San Bernardino National Forests are virtually surrounded by urban development. The level of development adjacent to the Cleveland and Los Padres National Forests continues to grow at a steady pace. Southern California's population has grown substantially over the last two decades to over 20 million people. The ethnic diversity of the population has increased and is evidenced by the approximately 30 languages used in the area. These challenges will continue to increase as the population grows by another 35 percent over the next two decades (Management Recommendations from Socioeconomic Assessment, 2002, Draft).

Growing recreation demand is a management challenge. Forest visitors are especially drawn to riparian areas (Angeles NF photo)



A highly adaptive approach to recreation management is needed to meet the challenges of new forms of outdoor recreation and the changing demographic profile of visitors. Conservation education programs are needed to teach national forest visitors about their connection and

dependence on the land, what is expected of them when they come to the national forests, and the potential effects their presence can have on the national forests. Forest staff will be challenged to develop partnerships and seek the assistance of volunteers to accommodate higher levels of use and to accomplish recreation objectives. Additional challenges will arise as visitation grows. Urban influences, and trends in lifestyles create the demand for convenient national forest access, improvements to facilities, environmental safeguards, and engaging conservation education programs.

The challenge of urbanization manifests itself in many ways and can be summarized by asking the question: "How will managers sustain the character of the national forests and maintain or improve forest ecosystems, while accommodating the demands of an increasing number of users in a large and growing urban area?"

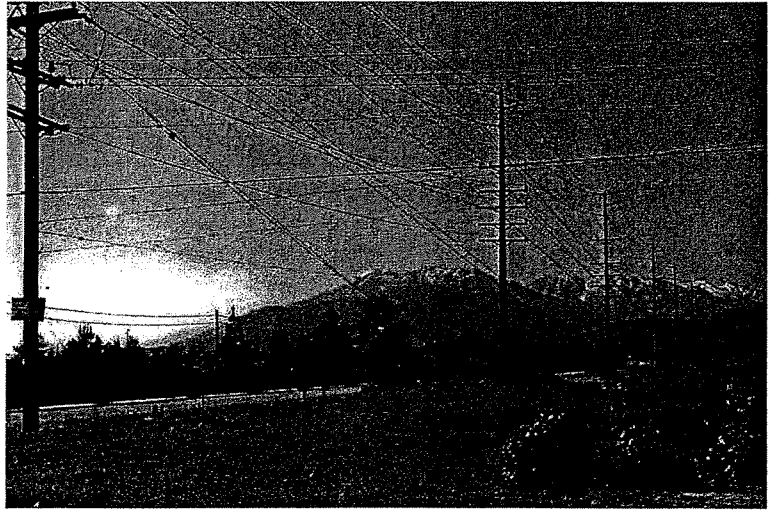
Management challenges related to urbanization include:

- increasing numbers of people coming to the national forests for a growing number of activities. There are increased demands for a variety of high quality year-round recreation opportunities, especially day-use activities including picnicking, driving and trail use, as well as access to dispersed areas where people recreate.
- accommodating the demand for recreation opportunities that meet the needs of diverse populations that have differing social and activity preferences.
- providing environmental education for an urban population that may be unfamiliar with the national forest environment.
- utilizing underserved community's input in the formulation and execution of project level work.
- retaining the opportunity for solitude in the face of the increasing population. As development of private areas continues, the Forest Service anticipates a greater dependence on the national forests for this type of value. Solitude defines itself and is becoming an increasingly rare opportunity in many areas of the national forests.
- accommodating the demand for an increasing variety of national forest products due to the diversity of the surrounding populations and the demand for products used for weaving, floral displays, medicinal, or other uses such as firewood. Managers are also challenged to effectively communicate with diverse populations of people in order to understand the ways they would like to use the national forests.
- accommodating the demand for energy fuels and industrial minerals for a growing and industrialized economy and population.

- accommodating the increasing demands from private, semi-private and public industry, corporations, organizations, associations and private individuals for requests for various uses on National Forest System lands. Managers are challenged to develop and sustain working relationships with authorized users to protect resources, resolve issues and continue to provide unique recreation opportunities.
- access to national forest land. Access is a complex problem that has many forms. For example, traditional points of access to the national forests are lost as private land is developed. New landowners are often reluctant to accommodate access across their land. At the same time, the people living adjacent to the national forests want convenient access, often resulting in the development of unplanned roads and trails. Balancing the human need for roads with their resource effects is another form of the access challenge. Most of the national forests' road systems were constructed in the 1930s for fire

Access

narrow and steep with few, if any, turnouts or other safety features. Limited budgets, maintenance backlogs, safety improvements, resource mitigation, road reconstruction or relocation, access and the decommissioning of roads are just a few of the challenges addressed in the Roads Analysis that Forest Service transportation planners face.

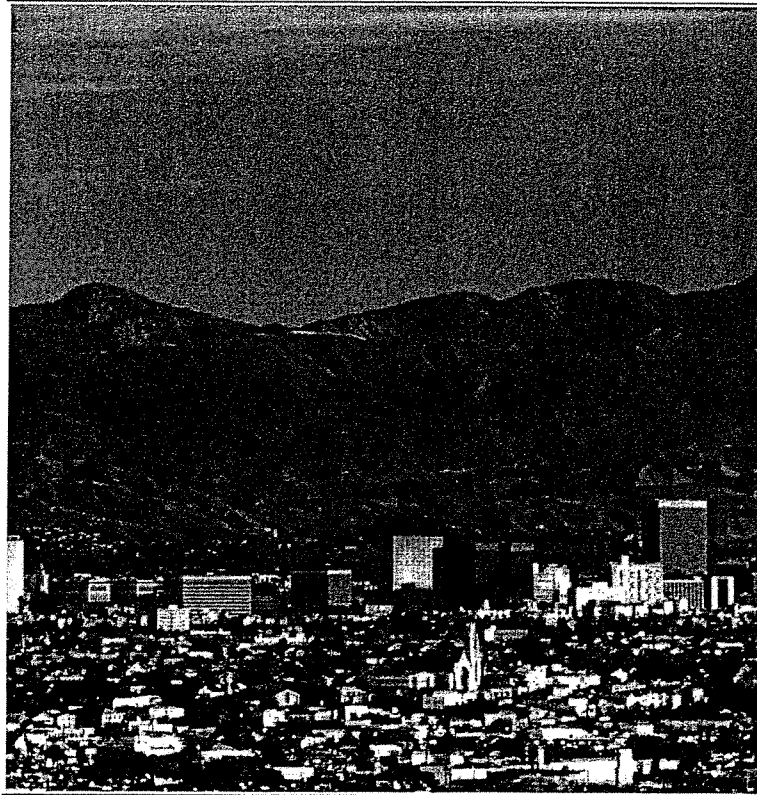


Accommodating urban infrastructure to support growing populations is a management challenge (Cleveland NF photo).

- infrastructure for community support. There are numerous facilities already located on the national forests including utility corridors, communication sites, dams, diversions, and highways. The role of the national forests and how they are used to safely accommodate additional facilities and to remove abandoned facilities, while retaining the character of the landscapes is a significant challenge.
- accommodating the demand for a wide variety of water uses with a limited supply of water in one of the driest climates in the United States. The demand for water for community, commercial, or private use has resulted in numerous impoundments, diversions and wells. Finding the delicate balance between peoples' need for water and the water necessary to sustain healthy riparian habitat and wetlands in the national forests will continue to be a challenge. Healthy, stable, and resilient watersheds absorb rain, refill aquifers, cool and cleanse water, slow storm runoff, reduce flooding, and provide important habitat for fish and wildlife. Water users include people (who are particularly attracted to water because of hot temperatures and the arid climate), downstream cities

and communities that use the water for municipal water supplies, as well as the numerous plant and animal species that depend on water for their survival. The demand for water can only increase as the population increases. Water is a complex challenge as the existing above-ground sources may be fully used and subsurface (groundwater) supplies are at a minimum heavily tapped for municipal or private water or for commercial uses (water bottling). Maintaining the quality of water is a challenge because of the intense levels of human use, air pollution, or natural events such as landslides, flooding and post-fire erosion. Managers are challenged to improve impaired watersheds.

Urban interface on the Angeles National Forest.



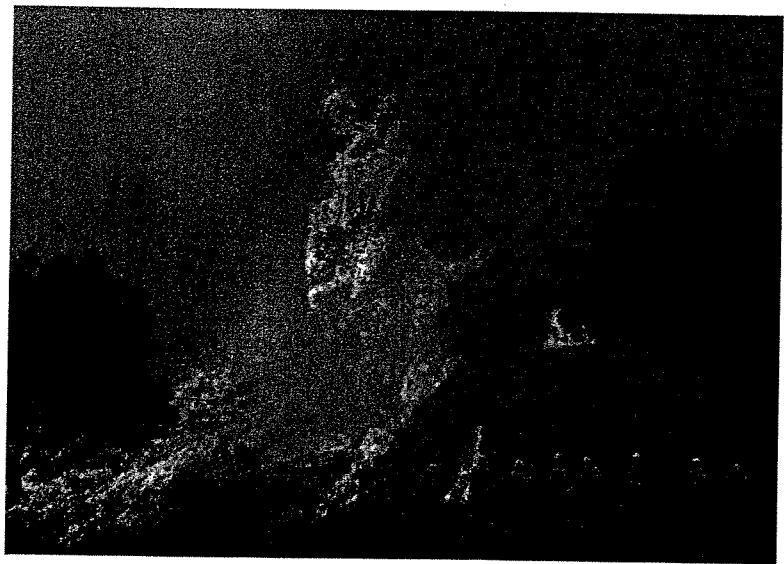
- continuing to provide law enforcement sufficient to protect resources and provide the level of service that is responsive to public need using innovative, non-traditional strategies as levels of use increase over time.
- understanding and protecting the historic and cultural sites that are abundant in the four southern California national forests. Numerous tribes live adjacent to or near the national forests. Managers are challenged to develop government-to-government relationships with the tribes in order to protect resources, to resolve access issues, supply resources and to continue the important traditional or cultural uses of the national forests.

Fire

Wildland fire may be the biggest challenge forest managers and the public face over the next couple of decades. Fire is a fact of life in southern California. Fire is not a question of if, rather, it is a question of when and how much damage. Fire staff have concluded that under the right conditions, a fire started anywhere on the four southern California national forests may be a

threat to adjacent communities. The four southern California national forests include over 3.5 million acres with thousands of structures in or around their borders that are threatened by wildland fire. The national forests are also located in one of the driest, most fire-prone areas in the United States. The situation is compounded by decades of fire suppression practices that have resulted in the development of unnaturally dense stands of trees and the accumulation of brush and other flammable fuels in many areas. Housing and other development adjacent to national forest boundaries is increasing at a rapid rate without adequate provision for the development of a 'defensible' space around them. Further compounding the complexity of the situation is the recent drought and insect infestation that is centered on the San Bernardino National Forest, but may be spreading toward the Angeles and Cleveland National Forests. Dead trees in and around communities and homes are an immediate challenge.

Preparedness
is a key
challenge in
southern
California.
Photo shows
Piru Fire,
October
2003, Los
Padres NF.



Finally, managers are challenged to offer a safe forest environment in potentially dangerous situations. Human safety is always the first priority of national forest managers. The Forest Service faces a huge challenge in southern California and most of the western United States to emphasize fuel treatments that result in defensible space in Wildland/Urban Interface (WUI) areas.

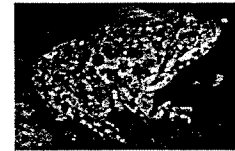
Management challenges related to fire include:

- working with other agencies, communities, and property owners to develop 'community defense zones' that allow firefighters to stay on-the-ground and defend homes and property more safely. The challenge is a long-term one that requires years of work to complete the vegetative treatments necessary to defend the communities. Another facet of the same challenge is to maintain the defensible conditions over time.
- reconciling the need to manage areas at risk where threatened, endangered, proposed, candidate, sensitive species live.
- reconciling the need to manage areas at risk where significant heritage resources are located, as well as areas of concern for tribes and Native American communities.

- increased fire frequency (most often the result of human causes) that has resulted in the loss of native plant species or conversion to an unnatural mix of vegetation. Management challenges will also include increased erosion potential and downstream flooding from burned areas.
- dead trees within and/or adjacent to communities. Entire communities, with a combined population of over 100,000 people are at risk of loss from fire. Based on the severity of the situation, the United States Congress recently placed the Angeles, Cleveland, and San Bernardino National Forests on the nation's 10 Most Fire-Threatened Forests list (California Fire Alliance).
- allowing fire to play a more natural role in an unnatural environment.

Wildlife and Plants

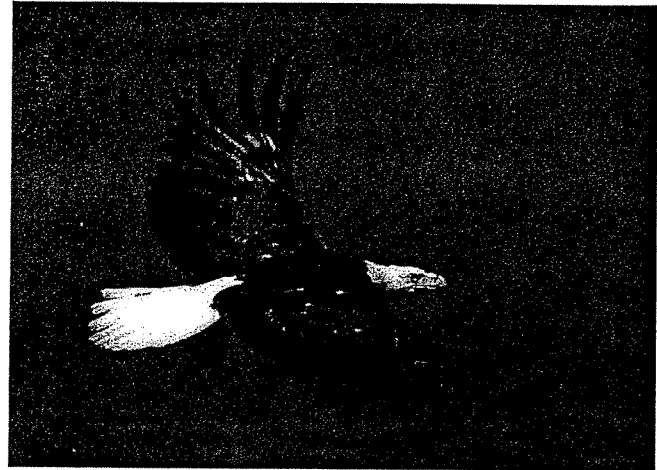
The four southern California national forests lie within a bioregion considered by Conservation International to be one of the world's 25 biodiversity 'hotspots.' High vegetation diversity, unique ecological communities found nowhere else, and many endemic species characterize this area. The number of species at risk of extinction is increasing at an alarming rate. In 1986, there were 17 listed threatened and endangered (T&E) species on the four national forests; in 2004, the number of T&E actually or potentially found on the four national forests increased to 62.



Management challenges related to wildlife and plants include:

- balancing the demands of people while providing habitat for imperiled species. The primary challenge is long-term conservation and recovery of at-risk and listed species.
- finding solutions to problems in freshwater aquatic habitats and montane meadows, which are relatively uncommon in southern California and have been substantially modified by dams, diversions and erosion. These areas support a large number of species of concern and are also places where people like to recreate because of water, shade, and cooler temperatures.
- developing education programs to help people learn that the simplest of activities, such as walking up a creek could harm an extremely rare or vulnerable species that lives there.
- sustaining water resources for riparian areas and wetlands where the streams are impounded or diverted for human use.
- collaborating in nontraditional formats with local communities and governments to maintain and restore habitat linkages between the national forests and other open space reserves. Similarly, many people recognize that communities and government organizations need to work together to restore connectivity of riparian habitat along streams that run from the national forests through communities and eventually out to the sea.
- arresting the spread or eradicating invasive nonnative plant and animal species that displace, prey upon, or otherwise harm native species and their habitats.
- managing forest pests under conditions of changing climate and altered natural fire regimes.

Providing habitat such as riparian areas and wetlands for imperiled species while balancing the demands of people is a challenge.



In the end, the fundamental challenge is for the people of southern California to collaborate in order to find solutions. This means working together in a nontraditional, coordinated, collaborative network of tribes, communities, government agencies, groups, organizations, and individuals to sustain the southern California national forests for the future, for our children, and for their children. The challenge includes defining the role of the national forests as the backdrop to, and respite from, the urbanized web of communities that surround them.

Through adaptive management over the course of the planning period, the Forest Service and communities of southern California will continuously seek a balanced and sustainable flow of goods and services for a growing diverse population while ensuring long-term ecosystem health, biological diversity, and species recovery.

Strategic Goals

Government Performance and Results Act Priority National Goals

The priority goals for the Forest Service are provided in the Forest Service National Strategic Plan (2003 Revision). The priority goals embody the Forest Service's many areas of responsibility, as captured in the agency's mission statement: "The mission of the USDA Forest Service is to sustain the health, diversity, and productivity of the nation's forests and grasslands to meet the needs of present and future generations."

National Strategic Plan, Goal 1 - Reduce the risk from catastrophic wildland fire

National Strategic Plan, Goal 2 - Reduce the impacts from invasive species

National Strategic Plan, Goal 3 - Provide outdoor recreation opportunities

National Strategic Plan, Goal 4 - Help meet energy resource needs

National Strategic Plan, Goal 5 - Improve watershed conditions

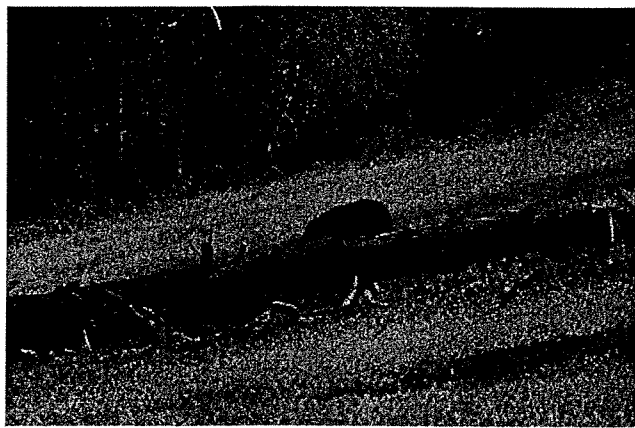
National Strategic Plan, Goal 6 - Mission related work in addition to that which supports the agency's goals

Keeping America's forests and grasslands healthy requires restoring and rehabilitating damaged areas to: (1) prevent severe wildland fires, (2) stop the introduction, establishment, and spread of invasive species, (3) reduce the conversion of forests and grasslands that lead to fragmentation of

rural landscapes through subdivision, and (4) manage impacts of motorized recreation vehicles by restricting use to designated roads and trails.

The Forest Service Strategic Plan (2003 Revision) provides a new framework for accomplishing the agency's mission and incorporates actions to resolve four major threats to America's forests and grasslands. Forest Service leadership is committed to removing the 'Four Threats' from the national landscape. This is a necessary action in order to achieve long-term outcomes: clean air, clean water, conserving wildlife, and protecting communities from wildland fire.

Forest Service actions to achieve these outcomes are important contributions to enhancing the quality of life for Americans.



Invasive species such as cheatgrass pose a threat to the ecosystem.

Actions needed to address the Four Threats include:

Fire and fuels—Restore healthy, disturbance-resilient ecosystems on lands that are at risk of catastrophic fire, improving the condition and function of critically important watersheds, and sustaining critical wildlife habitats nationwide.

Invasive species—Protect forest and rangeland ecosystems by preventing the release of non-native species and by controlling the spread of, or eradicating, invasive species.

Loss of open space—Conserve the nation's forests and rangelands most at risk (due to subdivision and land conversion) by working with partners, communities and landowners to balance development with sustaining ecosystem services and viable working landscapes.

Unmanaged recreation—Work with partners to develop travel management plans that regulate the use of off-highway vehicles (OHVs) on designated roads, trails, and parks in an appropriate manner.

Forest plans further refine these goals by developing desired condition statements and forest-specific objectives. The forest plans identify the role each national forest plays in working toward these national goals.

Forest Goals and Desired Conditions

This section includes a discussion of forest goals and desired conditions for resources. The goals are responsive to both national priorities and the management challenges identified for the four southern California national forests (Angeles, Cleveland, Los Padres and San Bernardino National Forests). Goal numbering is linked to the National Strategic Plan. Goals 1-6 and Goal 7 are linked to the national concern over loss of natural areas. For each goal, a brief background statement is given followed by a series of desired condition statements. Specific indicators and outcome evaluation questions are displayed for each major forest goal. Baseline conditions and projected trends in these indicators are found in the environmental impact statement (EIS). Monitoring of actual trends in these indicators will allow managers to determine if there is a need to change the forest plan through amendment or revision. This determination is reported in the Comprehensive Monitoring and Evaluation Report approximately every five years.

Natural Areas in an Urban Context

Goal 7.1 - Retain natural areas as a core for a regional network while focusing the built environment into the minimum land area needed to support growing public needs.

Urbanization within and surrounding national forest boundaries is threatening to alter the natural character of many areas. Suburban communities have been developed in more remote areas and urban areas have pushed up into the foothills in many places. This has led to an explosion in the amount of Wildland/Urban Interface areas that are at risk and in need of protection from wildland fire. The combination of increased development and the need to protect these developed areas from fire and other natural events (such as flooding) will put increasing pressure on national forest managers to alter landscape character to accommodate these uses.

Table 1-1. Ownership Complexity

Forest	Miles NFS	Miles/sq.mile	Miles Private	Miles/sq.mile
ANF	1,242	1.13	462	0.42
CNF	1,299	1.44	1,058	1.17
LPNF	2,918	0.95	1,728	0.56
SBNF	1,665	1.32	1,018	0.81

Table 1-1, Ownership Complexity, shows the relative complexity of land ownership based on miles of interface with private lands. As these lands develop, there is a high potential for significant increase in the interface between developed areas and national forest boundaries. There are currently about 1,700 miles of forest interface with developed areas on the four southern California national forests. This number could more than double in the future. Urban development also puts additional pressure on public lands to provide urban support facilities (infrastructure) through special-use authorizations as private land options for development are exhausted.

Extensive habitat conservation planning efforts led by local government and conservation organizations have identified the need to maintain an inter-connected network of undeveloped areas or landscape linkages, which retain specific habitats and allow for maintenance of biodiversity and wildlife movement across the landscape. These efforts have led to development



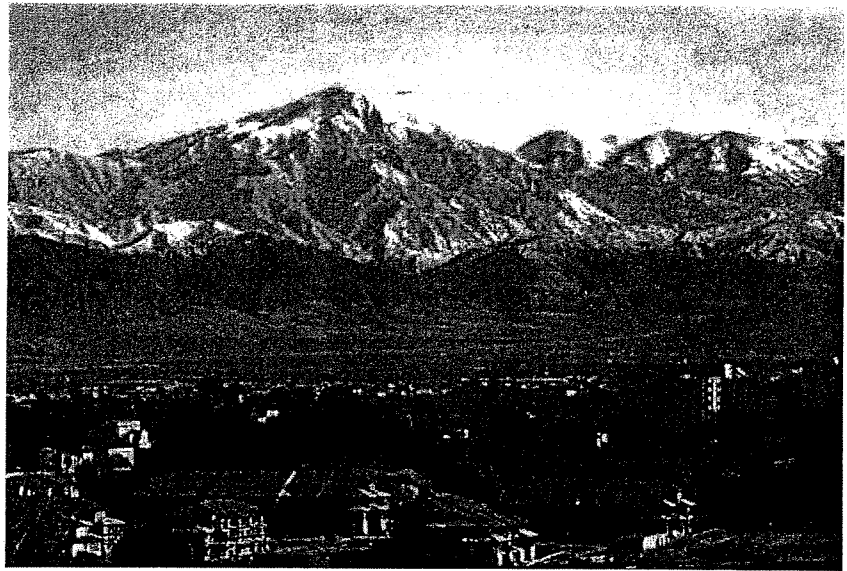
Habitat linkages are desired for movement of wildlife, such as the Peninsular bighorn sheep on the San Bernardino NF. Photo by BLM.

of several multi-species habitat conservation plans. National Forest System lands are a core element of this natural open space network and will play an increasingly important role as additional habitat fragmentation occurs on surrounding private lands.

The desired condition is that the natural and cultural features of landscapes that provide their 'sense of place' are intact. Landscapes possess a vegetation pattern and species mix that is natural in appearance and function. Built elements and landscape alterations complement landscape characteristics. Areas zoned as Back Country retain an undeveloped character with a low level of loss of acres in this condition.

National Forest facilities and infrastructures are high quality, well maintained, safe, accessible, consistent with visitor expectations, and support the Built Environment Image Guide principles. Facility maintenance meets established national standards. Structures are well integrated into the landscape and advance environmentally sensitive technology, such as water and energy efficiency and retention of habitat linkages.

Facilities supporting urban infrastructure needs are clustered on existing sites or designated corridors, minimizing the number of acres encumbered by special-use authorizations. Special-uses serve public needs, provide public benefits, and conform to resource management and protection objectives. All uses are in full compliance with the terms and conditions of the authorization. There is a low level of increase in



Urban interface near the San Bernardino NF.

the developed portion of the landscape as measured by road densities; in fact, over time, the built environment is shifted away from or designed to better protect resource values.

Land adjustment administration contributes to the reduction of the complexity of land ownership and consolidates the National Forest System land base; reduces administrative problems and costs; enhances public access and use; supports resource management objectives, including the protection and improvement of habitat condition and linkage. Strategic easements for access and species conservation are acquired. Clear title to National Forest System land is retained. Occupancy trespass is eliminated and national forest boundaries are clearly posted.

Outcome Evaluation Question: Is the national forest balancing the need for new infrastructure with restoration opportunities or land ownership adjustment to meet the desired conditions? (See implementation and effectiveness monitoring in Appendix C of Part 3.)



United States Department of
Agriculture

Forest Service

Pacific Southwest Region

R5-MB-076

September 2005



Land Management Plan

Part 2 Angeles National Forest Strategy

Excerpts



Soledad Front Country

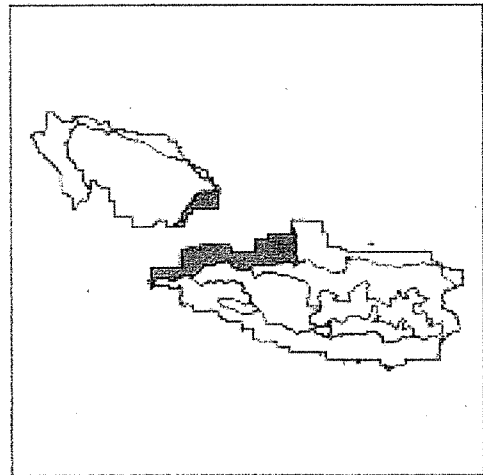
Theme: The Soledad Front Country Place functions as a scenic backdrop and transitional landscape between the rapidly urbanizing Mojave Desert and Los Angeles Basin. The flow of people and materials through this transitional landscape link the greater Los Angeles area to the Mojave Desert. The growing communities along California Interstate 14 are transforming this area from rural to urban in character. Residents of these new communities have the scenic views of the San Gabriel Mountains from their homes and travel corridors. The Pacific Crest National Scenic Trail occurs on a portion of the Place.

Setting: The Soledad Front Country Place runs northeast to southwest along both sides of California State Highway 14 along the Santa Clara and Soledad Rivers. This landscape is commonly defined as the area between California Interstate 5 at the southern end and the intersection of California State Highway 138 at the northern end. The northwest and southeast boundaries are, in general, defined by the area visible from California Highway 14. There is a Special Interest Area that highlights the heritage resource values of the area.

Elevations in the area range from about 2,100 feet to 3,000 feet. The broad floodplain of the Soledad River (with its various side drainages) dominates this landscape. The broad floodplain (which leads to steep slopes with rounded summits) is the most prevalent landform in this Place.

The mostly hot to sometimes temperate climate affects vegetation types and water availability. The predominate plant community at the lower elevations is mixed chaparral. Pine and juniper are present at higher elevations. Chaparral is continuous on most slopes. The chaparral is seen as patterns of dense patches with large openings. Canyon and coast live oaks are present in dense woodlands along shaded slopes and in the canyons. All but the larger streams are dry through the

summer. Several canyons, including Elsmere and Whitney, still exhibit pristine characteristics. However, human influences on the viewshed include the altered vegetation composition resulting from an increase in fire starts. Degradation of air quality is affecting forest health by stressing vegetation, resulting in lower water quality and productivity.

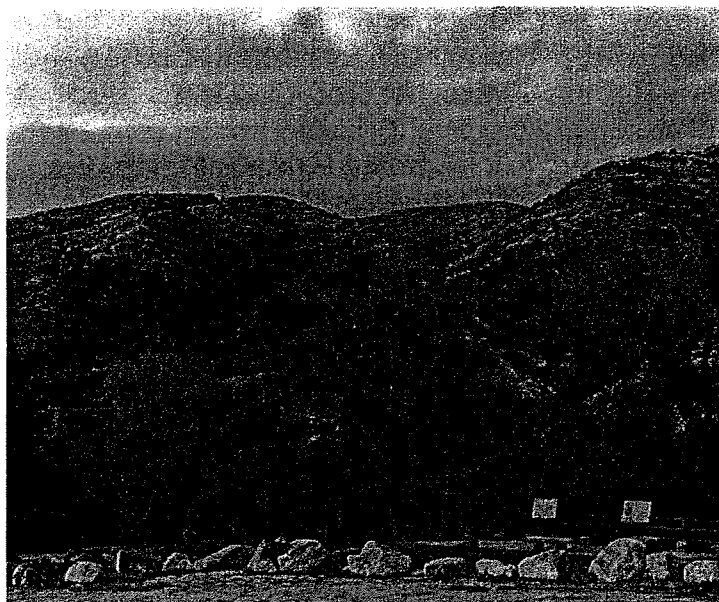


Most of the vegetative communities within the area are in the expected fire regime; however, there are areas that have a history of excessive fire occurrence. Safe conditions along the urban interface within this Place are inconsistent, and private landowners look to the Forest Service to create community defense zones. Fuel treatments have been limited in the past, and the focus of fire management is on property protection, concentrating on age class mosaics and fuelbreaks to reduce downstream flooding. The flood-fire sequence poses a problem to downstream housing developments. Wildland fires have resulted in high property and resources loss, and the numerous fire starts are moving vegetative communities towards type conversions.

A rich diversity of plant and animal species is present within Soledad Front Country.

Soledad Canyon includes habitat for the unarmored threespine stickleback, least Bell's vireo, southwestern willow flycatcher and numerous other riparian dependent species.

Opportunities for establishment of regional wildlife linkages to improve connectivity between the San Gabriel, Castaic and Santa Susana Mountains exist and are needed in this Place. Potential threats to sensitive habitat areas include developed and dispersed recreation, mining, wildland fire and groundwater extraction.



Soledad Canyon Wildlife Viewing Station, Soledad Front Country Place

The cultural landscape of the Soledad Front Country is rapidly converting from rural to urban due to the development of housing tracts along the national forest boundary. Human influences, such as urban development, intensive use areas, transportation corridors, utility corridors, sand and gravel mining, road cuts and flood control channels are creating strong visual contrasts and user conflicts within this Place. Most facilities and trails are located along drainages, ridge tops or cut into hillsides. Urban development is affecting access to National Forest System roads and trails, and residents of adjacent developments are creating social trails on national forest land. Encroachment has increased due to urbanization resulting in problems of trespass, fire, and resource damage.

Trailheads and travel routes offer visitors year-round access to the Angeles National Forest. The trails through the Place lead visitors by dramatic canyon and rugged mountain views. The area has a rich history and is known for a high occurrence of heritage resource sites. Recreation opportunities such as hiking the Pacific Crest National Scenic Trail and managed OHV areas occur within this Place. Recreation use is conflicting with other resources, and facilities are aging and do not meet Americans with Disabilities Act or the National Forests and Grasslands Built Environment Image Guide (BEIG). Environmental education venues (including the Placerita Nature Center) are present in the area, but there is no unifying, overview or integrated focus.

This area accommodates other human uses and needs, such as providing the backdrop for movies and television shows, mining activities, electric utility and distribution lines, and water extraction. However, the supply of both ground and surface water does not adequately provide for forest ecosystem health and other demands. A variety of special-use authorizations exist in this Place that range from electronic sites to shooting areas. Past oil and gas development has also occurred in or near this Place, and there may be the potential for future oil and gas exploration and development.

The Place has many existing activities that are not authorized. Problems in the canyons associated with human use, such as trash and car dumping, partying, graffiti, illegal OHV use, and closure maintenance are persistent. Law enforcement coverage is inadequate, especially at night.

Special Interest Areas:

- Aliso - Arrastre Middle and North 7,850 acres

Proposed Critical Biological Zones (see table 524: Angeles NF Critical Biological Land Use Zones, page 11)

- Soledad Canyon

Total national forest acres--Soledad Front Country Place: 59,338

Desired Condition: The Soledad Front Country Place is identified as a "Key Place" for its natural appearing area that functions as a scenic backdrop and transitional landscape. The valued landscape attributes to be preserved over time are the dramatic canyon and rugged mountain views, the presence of pine and juniper stands, and a well-defined age class mosaic with patches in chaparral. Heritage resources are managed to standard under a comprehensive and integrated management plan. Wildlife linkages connecting the San Gabriel Mountains to the Castaic and Santa Susana Mountains is established and functioning. Habitat conditions for threatened, endangered, proposed, candidate and sensitive species are improving over time. Exotic species are reduced and controlled over time. Private land between the two mountain ranges is acquired and the Pacific Crest National Scenic Trail is connected.

Program Emphasis: Management emphasis is expected to focus on the protection of communities from the threat of fire, the management of high levels of recreation use, and the maintenance of urban and forest infrastructures (facilities). The success of this emphasis is dependent on a sustainable level of development and the delicate balance between the needs of people and the effects of those uses on the plant and animal communities in the national forest. Uses must be balanced to promote the conservation of valuable natural resources and to sustain the needs of people. The significance of the heritage resources in the Place is recognized through the designation of special areas managed for the heritage resource value. Special emphasis will be given to acquiring private land between the San Gabriel and Sierra Pelona Mountain Ranges in order to connect the Pacific Crest National Scenic Trail. The national forest will focus on protection of open space and boundary management in anticipation of future adjacent development.

The national forest is active in regional planning efforts to establish a wildlife linkage connecting the San Gabriel Mountains to the Sierra Pelona and Santa Susana Mountains. Uses and activities are managed to provide opportunities for establishment of regional wildlife linkages in the Soledad Front Country Place. Protection and enhancement of threatened, endangered, proposed, candidate and sensitive species, such as the unarmored threespine stickleback, arroyo toad, southwestern willow flycatcher, least Bell's vireo, San Diego horned lizard, two-striped garter snake and sensitive plants will be emphasized in all activities. Arundo and other exotic species eradication to restore healthy riparian systems will continue to be emphasized.

Special emphasis will be given to acquiring private land between the San Gabriel and Castaic Mountain Ranges in order to connect the Pacific Crest National Scenic Trail.

Appendix B - Program Strategies and Tactics

This section details the program strategies the national forests may choose to emphasize to progress toward achieving the desired conditions and goals described in Part 1. The national forests will prioritize which strategies they choose to bring forward in any given year using the program emphasis objectives, national and regional direction, and available funding. Lists of more specific tactics are included to help the reader understand what may be involved in implementing these strategies. Finally, each strategy that supports a Government Performance and Results Act (GPRA) goal and objective is linked to the 2004-2008 National Strategic Plan. Please note, the strategies may not be numbered consecutively. The strategies listed in Appendix B are those the Angeles National Forest managers intend to emphasize in the next three to five years (2006 through 2008-2010).

Link 1 - Habitat Linkage Planning

Identify linkages to surrounding habitat reserves and other natural areas for maintaining biodiversity. Collaborate with local government, developers, and other entities to complement adjacent federal and non-federal land use zones and associated design criteria:

- Participate in regional planning efforts to identify linkages to surrounding habitat reserves and other natural areas for maintaining biodiversity.
- Work with land conservancies, local government and others to secure long-term habitat linkages.
- Manage national forest use and activities to be compatible with maintaining habitat linkages.
- Actively participate with local government, developers, and other entities to protect national forest values at intermix and interface zones.

Linked to National Strategic Plan

Goal 6 - Mission related work in addition to that which supports the agency goals, objective 3.



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Pacific Southwest
Region

Angeles
National Forest

Cleveland
National Forest

Los Padres
National Forest

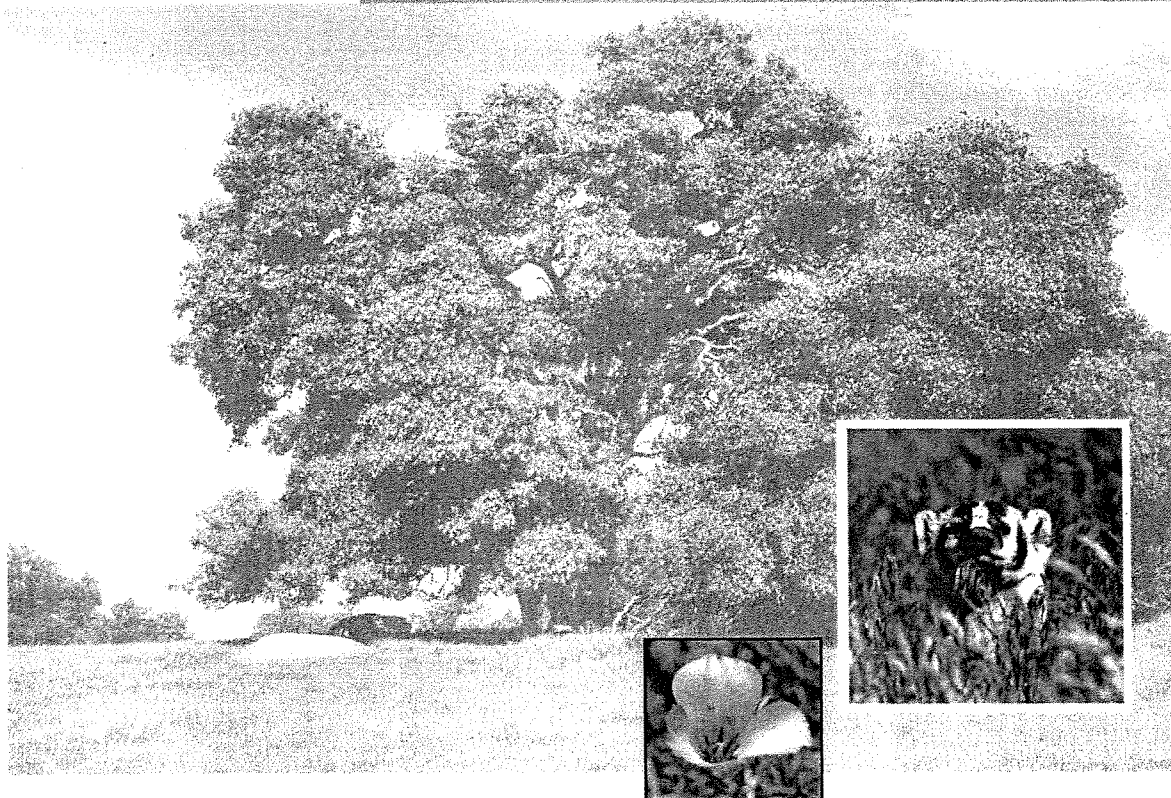
San Bernardino
National Forest

Southern California Mountains and Foothills Assessment

Habitat and Species Conservation Issues

Excerpts

General Technical Report
PSW-GTR-172



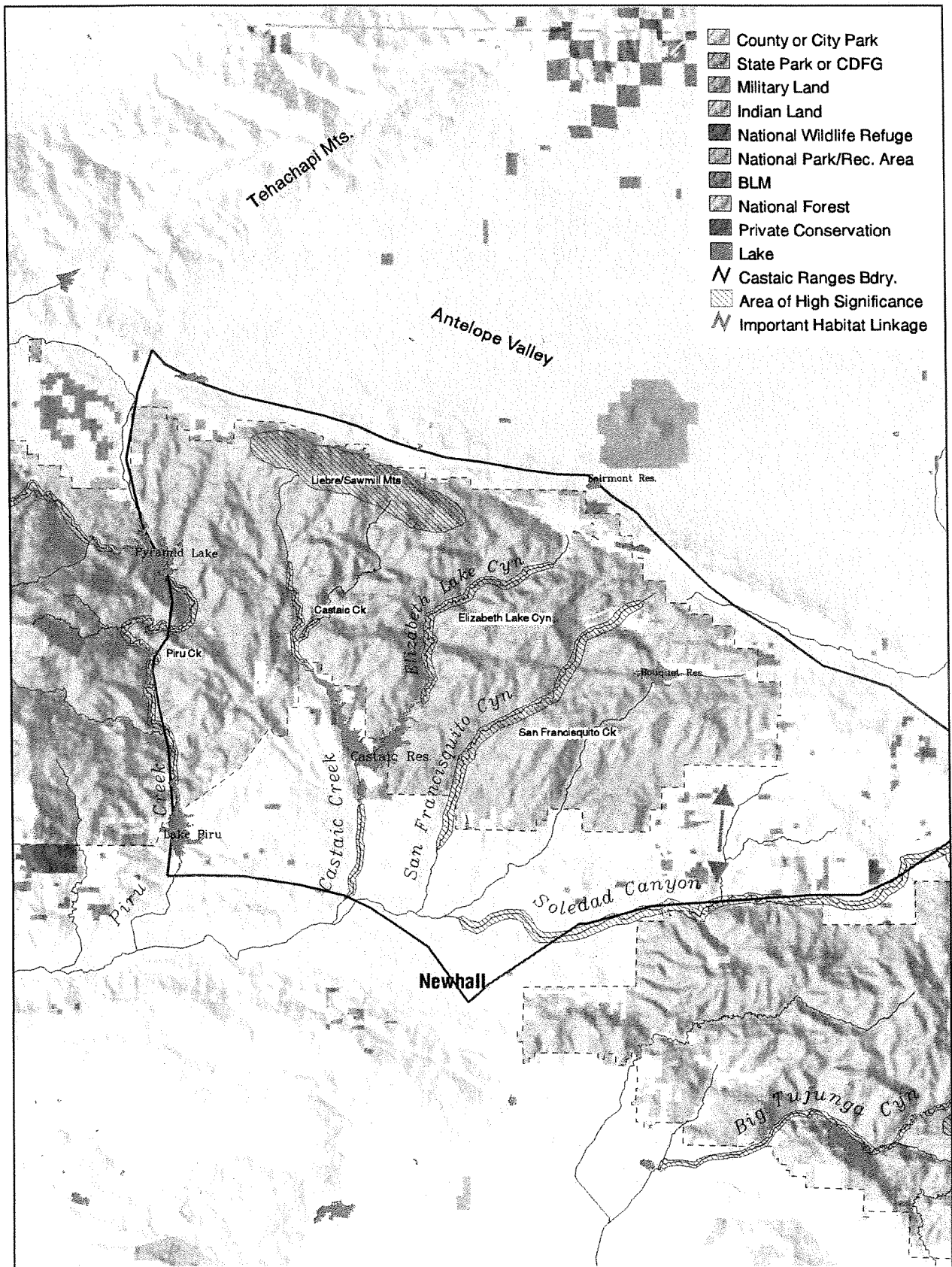


Figure 7.6. Areas of high ecological significance in the Castaic Ranges.

Chapter 7 – Areas of High Ecological Significance

The problem, then, is how to bring about a striving for harmony with land among a people many of whom have forgotten that there is any such thing as land, among whom education and culture have become almost synonymous with landlessness.

— Aldo Leopold, 1949

Key Questions

- Which areas have particularly high ecological significance and what makes them significant?
- What factors threaten the ecological integrity of these areas?

This final chapter identifies areas of particularly high ecological significance in each of the assessment area's nine mountain regions. These "key places" include critical habitats for rare and vulnerable species, areas of high ecological integrity, and locations with unique ecological associations. Primarily they are places where a number of ecologically significant features overlap. Thus, the need for effective stewardship of these areas is particularly important.

The areas identified in this chapter clearly do not represent all areas of ecological importance and should not be interpreted as such. The purpose of highlighting these places is to increase public and agency awareness of their regional significance. They are key parts of the ecological heritage of southern California and should be recognized as such.

San Diego Ranges

The mountains and foothills of San Diego County contain a large number of rare species and habitats. The list of key ecological areas for this region is dominated by some of the best remaining occurrences of low-elevation ecosystems (e.g., riparian woodland, coastal sage scrub, grassland, and Engelmann oak woodland) that are poorly represented on

public lands and declining in the southern part of the assessment area (fig. 7.1).

Public lands and habitat reserves are patchily distributed in the San Diego ranges. As development intensifies in the foothills, far-sighted planning is needed to ensure that habitat connectivity is maintained between the mountains and the remaining natural areas in the coastal and inland valleys.

Upper San Luis Rey River and the Warner Basin

An approximately 4-mile stretch of riparian habitat along the San Luis Rey River below Lake Henshaw supports the largest southwestern willow flycatcher population in southern California. Above the lake, there are significant populations of arroyo toad and arroyo chub in the West Fork, North Fork, and Agua Caliente Creek. Extensive grasslands in the Warner Basin are occupied by Stephens kangaroo rat. The basin is also one of the few areas in southern California where the red-sided garter snake has recently been observed. Lake Henshaw supports a wintering population of approximately four to ten bald eagles. Gray vireos occur in redshank chaparral habitats on the north end of the basin.

Factors affecting the ecological integrity of this area include surface and groundwater extraction on private lands above Lake Henshaw. The San Luis Rey River below the lake is regulated by water releases from the dam. Much of the Warner Basin is intensively grazed by cattle. Brown-headed cowbirds are common in the area. Several roads and developed

known to occur in this area. It is a historic locality for the Los Angeles pocket mouse, coastal black-tailed jackrabbit, and badger, and these species may still occur here.

Urban development is occurring at a rapid rate along the border of the national forest in the uplands surrounding Lytle and Cajon washes. Sand and gravel mining is also a major activity in portions of these washes.

Big Tujunga Creek

Although this stream is dammed at an elevation of approximately 2,400 feet, there is still important riparian and aquatic habitat both upstream and downstream of the reservoir. Big Tujunga Creek continues to support populations of the Santa Ana sucker and arroyo chub. Santa Ana speckled dace historically occurred in the drainage but may have been extirpated. Arroyo toads, pond turtles, and Swainson's thrush also occur here.

Introduced red shiners occur below the reservoir and have been blamed for the decline of native fish in this drainage and the possible extirpation of speckled dace. Non-native aquatic species are a large problem in this drainage due to the mid-elevation reservoir. Variable and sometimes extreme releases of water from the dam are a threat to downstream fish and aquatic amphibian populations. Recreation use is high along this stream, particularly in the lower canyon, and has resulted in habitat degradation in some areas.

Upper San Antonio and Lytle Creek Watershed

The steep slopes around Mount San Antonio (also known as Mount Baldy) and in the upper forks of Lytle Creek are important habitat for Nelson's bighorn sheep. The recently discovered San Gabriel Mountain slender salamander also occurs in this area.

The remoteness of these upper watershed areas is critical to the continued existence of bighorn sheep in the San Gabriel Mountains. Increased demand for recreation developments in this area threatens the remote character. Altered fire regimes also may be changing the

distribution and availability of some habitat types that are important to bighorn sheep.

Castaic Ranges

The mountains and foothills north of Castaic are dominated by chaparral-covered hills, but they also contain several low-elevation streams that have high-quality riparian and aquatic habitats (fig 7.6). In addition, the upper elevations of Liebre and Sawmill mountains contain unique and important montane habitats. The geographic position of this region—between the San Gabriel Mountains to the east, the Tehachapi Mountains to the north, and the Los Padres ranges to the west—makes it a key wildland linkage. A 4- to 6-mile break in the connectivity of public lands exists between the San Gabriel Mountains and the westernmost part of this region, the Sierra Pelona Mountains. Protected habitat corridors will be needed between these ranges as development intensifies along Interstate 14.

Soledad Canyon

Soledad Canyon contains high-quality riparian and aquatic habitat. Portions of the upper Santa Clara River in this canyon are designated as critical habitat for the unarmored threespine stickleback fish. Santa Ana suckers, southwestern willow flycatchers, and summer tanagers also occur in this area.

A principal factor affecting the ecological integrity of Soledad Canyon is that most of the area is on private land and subject to increasing development. Invasive, non-native species are also a problem, particularly arundo and warm-water fish.

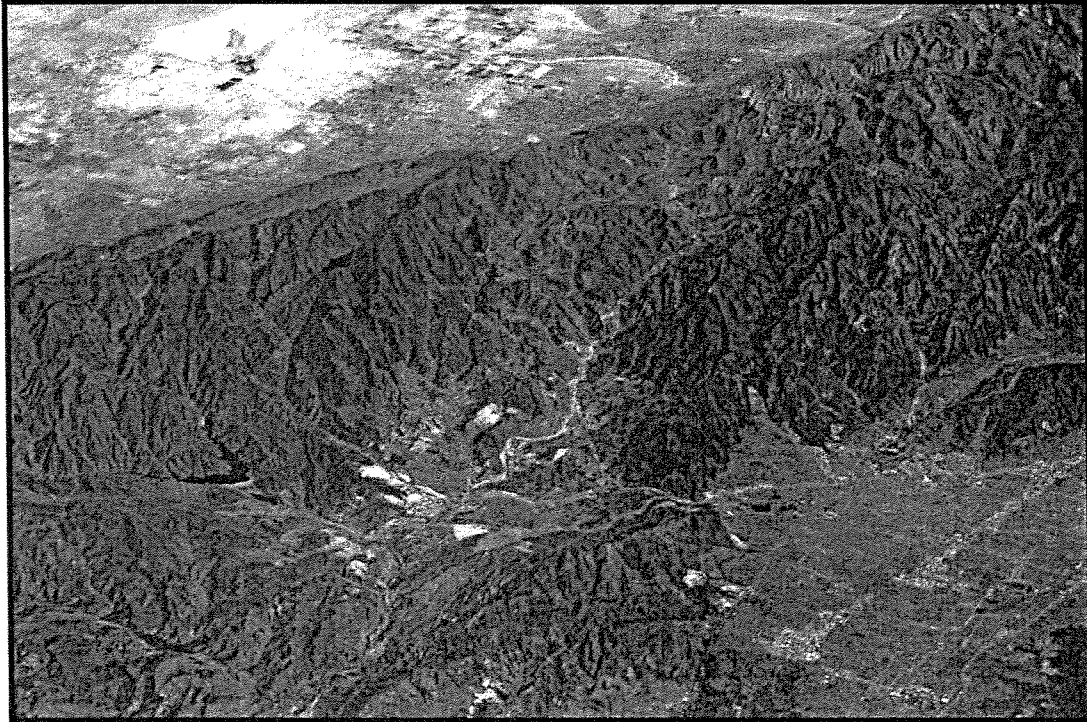
San Francisquito Creek

San Francisquito Creek contains high-quality, low-elevation riparian and aquatic habitat. The unarmored threespine stickleback, California red-legged frog, southwestern willow flycatcher, Swainson's thrush, yellow-breasted chat, and Nevin's barberry all occur along this drainage.

The primary factors affecting ecological integrity in the area are water diversions,

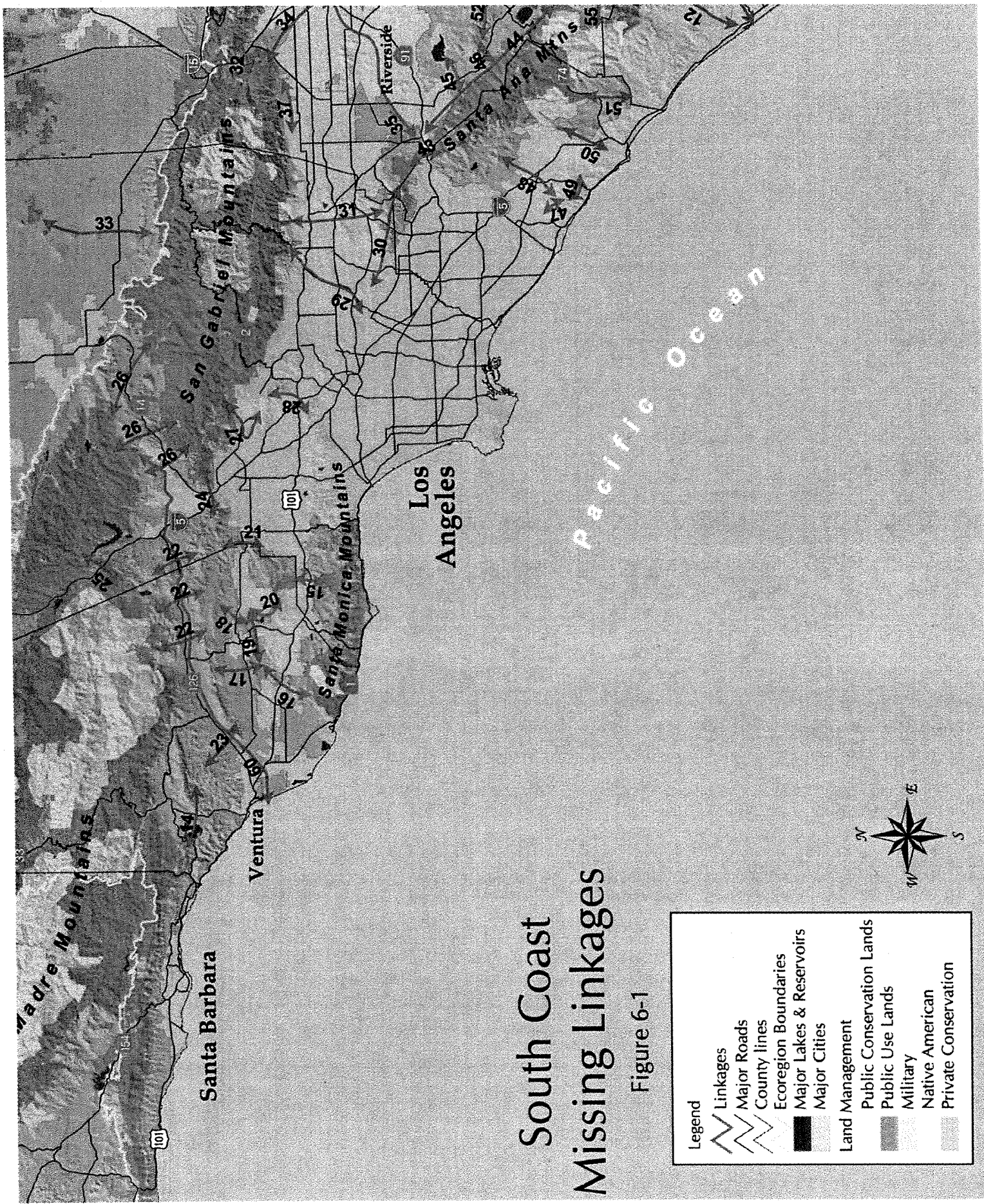
South Coast Missing Linkages Project

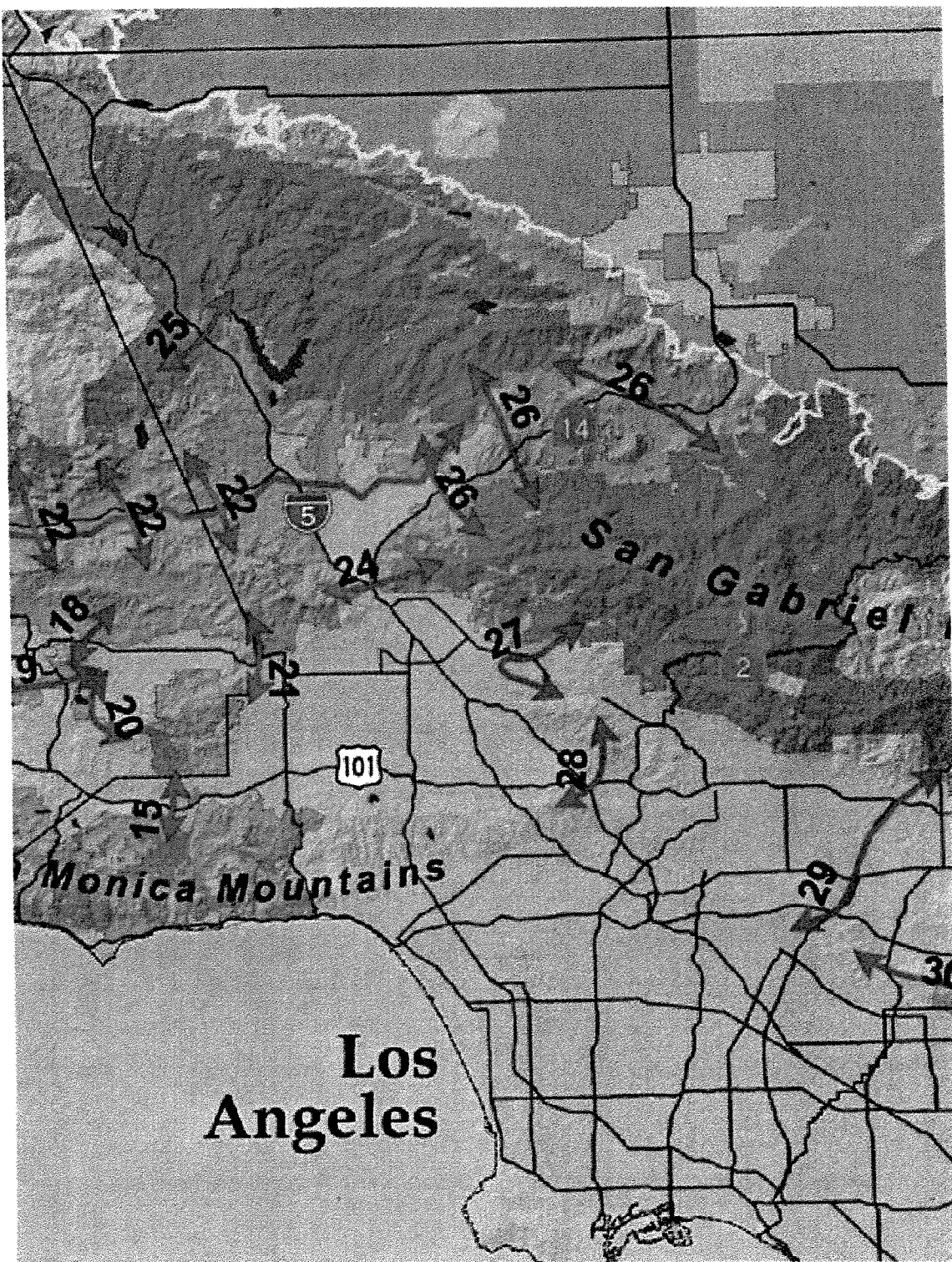
A Linkage Design for the San Gabriel-Castaic Connection



South Coast Wildlands

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www.calwild.org/resources/pubs/linkages/scoast.jpg

South Coast Missing Linkages Project

A Linkage Design for the San Gabriel-Castaic Connection



SOUTH COAST WILDLANDS

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March 2004

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Produced by South Coast Wildlands: Our mission is to protect, connect and restore the rich natural heritage of the South Coast Ecoregion through the establishment of a system of connected wildlands.

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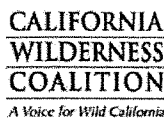
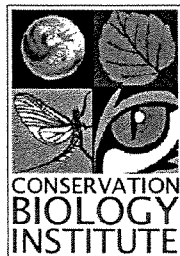
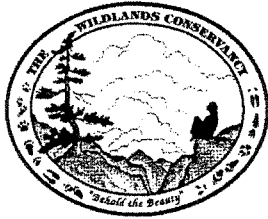


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Executive Summary

Habitat loss and fragmentation are the leading threats to biodiversity, both globally and in southern California. Efforts to combat these threats must focus on conserving well-connected networks of large wildland areas where natural ecological and evolutionary processes can continue operating over large spatial and temporal scales—such as top-down regulation by large predators, and natural patterns of gene flow, pollination, dispersal, energy flow, nutrient cycling, inter-specific competition, and mutualism. Adequate landscape connections will thereby allow these ecosystems to respond appropriately to natural and unnatural environmental perturbations, such as fire, flood, climate change, and invasions by alien species.

The tension between fragmentation and conservation is particularly acute in California, because our state is one of the 25 most important hotspots of biological diversity on Earth. And nowhere is the threat to connectivity more severe than in southern California—our nation's largest urban area, and still one of its fastest urbanizing areas. But despite a half-century of rapid habitat conversion, southern California retains some large and valuable wildlands, and opportunities remain to conserve and restore a functional wildland network here.

Although embedded in one of the world's largest metropolitan areas, Southern California's archipelago of conserved wildlands is fundamentally one interconnected ecological system, and the goal of South Coast Missing Linkages is to keep it so. South Coast Missing Linkages is a collaborative effort among a dozen governmental and non-governmental organizations. Our aim is to develop Linkage Designs for 15 major landscape linkages to ensure a functioning wildland network for the South Coast Ecoregion, along with connections to neighboring ecoregions. The San Gabriel-Castaic Connection is perhaps our most threatened linkage, and the last chance for a coastal connection between these ranges.

On September 30, 2002, 90 participants representing over 40 agencies, academic institutions, land managers, land planners, conservation organizations, and community groups met to establish biological foundations for planning landscape linkages in the San Gabriel-Castaic Linkage. They identified 15 focal species that are sensitive to habitat loss and fragmentation here, including 2 plants, 1 insect, 1 amphibian, 3 reptiles, 4 birds and 4 mammals. These focal species cover a broad range of habitat and movement requirements: some are widespread but require huge tracts of land to support viable populations (e.g., mountain lion, badger, California spotted owl); others are species that are restricted to the linkage planning area (e.g., burrowing owl). Many are habitat specialists (e.g., pond turtle in riparian habitat, or acorn woodpecker in oak woodlands) and others require specific configurations of habitat elements (e.g. two-striped garter snake). Together, these 15 species cover a wide array of habitats and movement needs in the region, so that planning adequate linkages for them is expected to cover connectivity needs for the ecosystems they represent.

To identify potential routes between existing protected areas we conducted landscape permeability analyses for 5 focal species for which appropriate data were available. Permeability analyses model the relative cost for a species to move between protected core habitat or population areas. We defined a least-cost corridor—or best potential route—for each species, and then combined these into a Least Cost Union covering all 5 species. We then analyzed the size and configuration of suitable habitat patches within this Least Cost Union for all 15 focal species to verify that the final Linkage Design would suit the live-in or move-through habitat needs of all. Where the Least Cost Union omitted areas essential to the needs of a particular species, we expanded the Linkage Design to accommodate that species' particular requirements to produce a final Linkage Design (Figure ES-1).

We also visited priority areas in the field to identify and evaluate barriers to movement for our

focal species. In this plan we suggest restoration strategies to mitigate those barriers, with special emphasis on opportunities to reduce the adverse effects of State Route 14.

The ecological, educational, recreational, and spiritual values of protected wildlands in the South Coast Ecoregion are immense. Our Linkage Design for the San Gabriel-Castaic Connection represents an opportunity to protect a truly functional landscape-level connection. The cost of implementing this vision will be substantial—but the cost is small compared with the benefits. If implemented, our plan would not only permit movement of individuals and genes between the San Gabriel and Castaic Ranges, but should also conserve large-scale ecosystem processes that are essential to the continued integrity of existing conservation investments throughout the region. We hope that our biologically based and repeatable procedure will be applied in other parts of California and elsewhere to ensure continued ecosystem integrity in perpetuity.

Nature Needs Room to Move

Movement is essential to wildlife survival, whether it be the day-to-day movements of individuals seeking food, shelter, or mates, dispersal of offspring (e.g., seeds, pollen, fledglings) to new home areas, or migration of organisms to avoid seasonally unfavorable conditions (Forman 1995). Movements can lead to recolonization of unoccupied habitat after environmental disturbances, the healthy mixing of genes among populations, and the ability of organisms to respond or adapt to environmental stressors. Movements in natural environments lead to complex mosaics of ecological and genetic interactions at various spatial and temporal scales.

In environments fragmented by human development, disruption of movement patterns can alter essential ecosystem functions, such as top-down regulation by large predators, gene flow, natural patterns and mechanisms of pollination and seed-dispersal, natural competitive or mutualistic relationships among species, resistance to invasion by alien species, and prehistoric patterns of energy flow and nutrient cycling. Without the ability to move among and within natural habitats, species become more susceptible to fire, flood, disease and other environmental disturbances and show greater rates of local extinction (Soulé and Terborgh 1999). The principles of island biogeography (MacArthur and Wilson 1967), models of demographic stochasticity (Shaffer 1981, Soulé 1987), inbreeding depression (Schonewald-Cox et al. 1983; Mills and Smouse 1994), and metapopulation theory (Levins 1970, Taylor 1990, Hanski and Gilpin 1991) all predict that isolated populations are more susceptible to extinction than connected populations. Establishing connections among natural lands has long been recognized as important for sustaining natural ecological processes and biological diversity (Noss 1987, Harris and Gallagher 1989, Noss 1991, Beier and Noss 1998, Beier and Loe 1992, Noss 1992, Beier 1993, Forman 1995, Hunter 1999, Crooks and Soulé 1999, Soulé and Terborgh 1999, Penrod et al. 2001, Crooks 2001, Tewksbury et al. 2002, Forman et al. 2003).

Patterns of Habitat Conversion

As a consequence of rapid habitat conversion to urban and agricultural uses, the South Coast Ecoregion (Figure 1) of California has become a hotspot for species at risk of extinction. California has the greatest number of threatened and endangered species in the continental U.S., representing nearly every taxonomic group, from plants and invertebrates to birds, mammals, fish, amphibians, and reptiles (Wilcove et al. 1998). In an analysis that identified "irreplaceable" places for preventing species extinctions (Stein et al. 2000), the South Coast Ecoregion stood out as one of the six most important areas in the United States (along with Hawaii, the San Francisco Bay Area, Southern Appalachians, Death Valley, and the Florida Panhandle). The ecoregion is part of the California Floristic Province, one of 25 global hotspots of biodiversity, and the only one in North America (Mittermeier et al. 1998, Mittermeier et al. 1999).

A major reason for regional declines in native species is the pattern of habitat loss. Species that once moved freely through a mosaic of natural vegetation types are now being confronted with a man-made labyrinth of barriers, as roads, homes, businesses,



and agricultural fields fragment formerly expansive natural landscapes. Movement patterns crucial to species survival are being permanently altered at unprecedented rates. Countering this threat requires a systematic approach for identifying, protecting, and restoring functional connections across the landscape to allow essential ecological processes to continue operating as they have for millennia.

A Statewide Vision

In November 2000, a coalition of conservation and research organizations (California State Parks, California Wilderness Coalition, Center for Reproduction of Endangered Species, San Diego Zoo, The Nature Conservancy, and U.S. Geological Survey) launched a statewide interagency workshop—Missing Linkages: Restoring Connectivity to the California Landscape—at the San Diego Zoo. The workshop brought together over 200 land managers and conservation ecologists representing federal, state, and local agencies, academic institutions, and non-governmental organizations to delineate habitat linkages critical for preserving the State's biodiversity. Of the 232 linkages identified at the workshop, 69 are associated with the South Coast Ecoregion (Penrod et al. 2001).

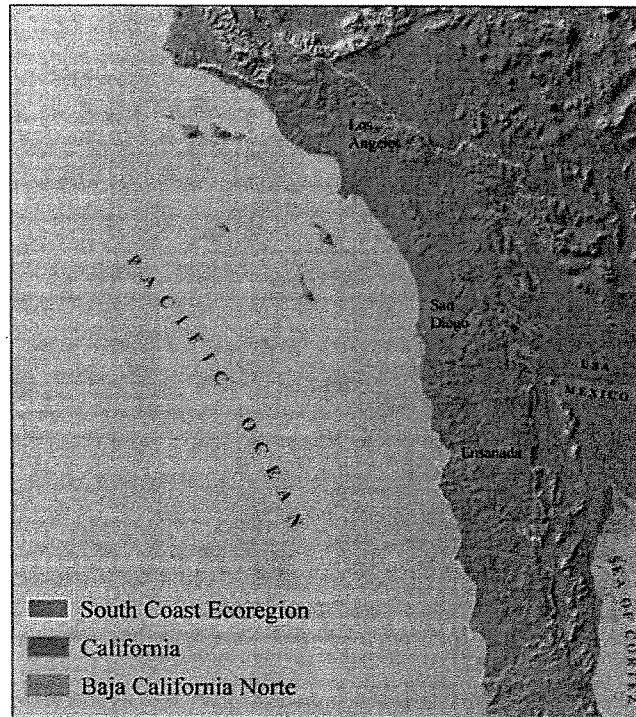


Figure 1. South Coast Ecoregion encompasses roughly 8% of California and extends 300 km (190 mi) into Baja California.

South Coast Missing Linkages: A Vision for the Ecoregion

Following the statewide Missing Linkages conference, South Coast Wildlands, a non-profit organization established to pursue habitat connectivity planning in the South Coast Ecoregion, brought together regional ecologists to conduct a formal evaluation of these 69 linkages. The evaluation was designed to assess the biological irreplaceability and vulnerability of each linkage (*sensu* Noss et al. 2002). Irreplaceability assessed the relative biological value of each linkage, including both terrestrial and aquatic criteria: 1) size of habitat blocks served by the linkage; 2) quality of existing habitat in the smaller habitat block; 3) quality and amount of existing habitat in the proposed linkage; 4) linkage to other ecoregions or key to movement through ecoregion; 5) facilitation of seasonal movement and climatic change; and 6) addition of value for aquatic ecosystems. Vulnerability was evaluated using recent high-resolution aerial photographs, local planning documents, and other data. This process identified 15 linkages of crucial biological value that are likely to be irretrievably compromised by



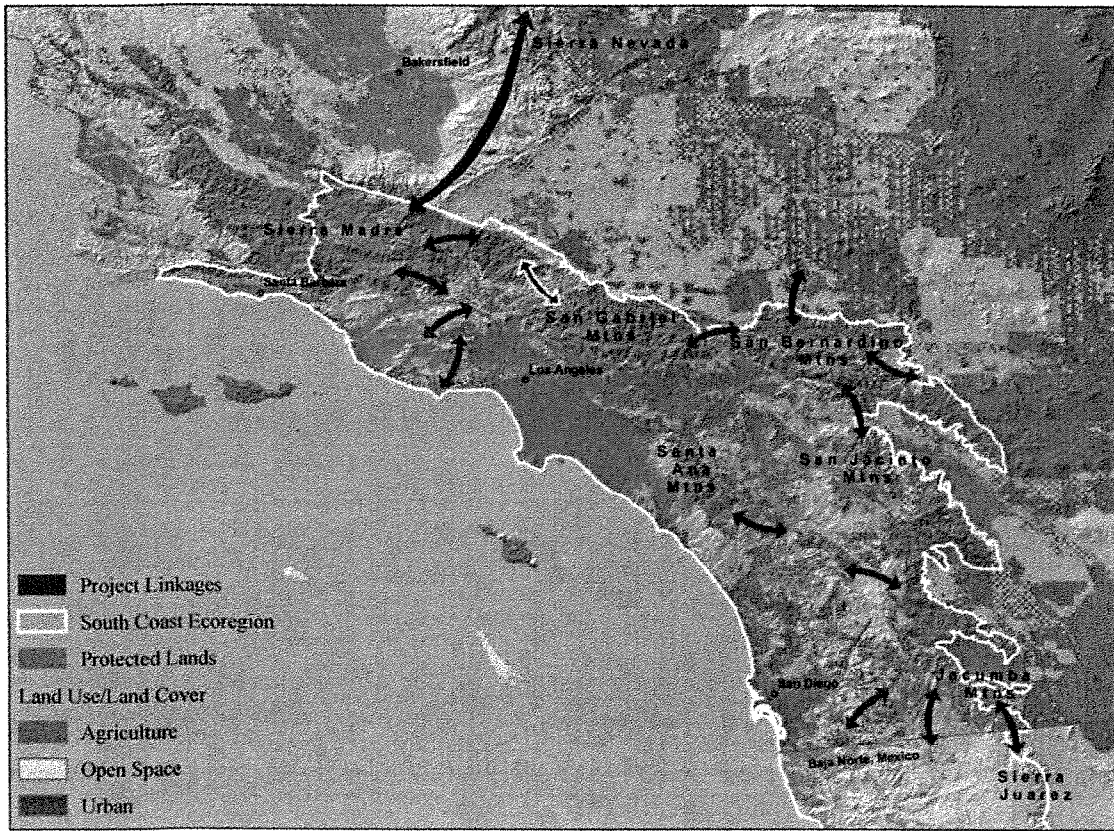


Figure 2. The South Coast Missing Linkages Project addresses habitat fragmentation at a landscape scale, and the needs of a variety of species. The San Gabriel-Castaic Linkage is one of 15 landscape linkages identified as irreplaceable and imminently threatened.

development projects over the next decade unless immediate conservation action occurs (Figure 2). The biological integrity of several thousand square miles of the very best Southern California wildlands would be irreversibly jeopardized if these linkages were lost.

Identification of these 15 priority linkages launched the South Coast Missing Linkages Project. This project is a highly collaborative effort among federal and state agencies and non-governmental organizations to identify and conserve landscape-level habitat linkages to protect essential biological and ecological processes in the South Coast Ecoregion. Partners include but are not limited to: South Coast Wildlands, The Wildlands Conservancy, The Resources Agency California Legacy Project, California State Parks, California State Parks Foundation, United States Forest Service, National Park Service, Santa Monica Mountains Conservancy, Conservation Biology Institute, San Diego State University Field Stations Program, The Nature Conservancy, Environment Now, The Wildlands Project, and the Zoological Society of San Diego Center for Reproduction of Endangered Species. Cross-border alliances have also been formed with Pronatura, Universidad Autonoma de Baja California, and Conabio to further the South Coast Missing Linkages initiative in northern Baja. It is our hope that the South



Coast Missing Linkages effort will serve as a catalyst for directing funds and attention toward the protection of ecological connectivity for the South Coast Ecoregion and beyond.

To this end, South Coast Wildlands is coordinating and hosting regional workshops, providing resources to partnering organizations, conducting systematic GIS analyses for all 15 linkages, and helping to raise public awareness regarding connectivity needs in the ecoregion. South Coast Wildlands has taken the lead in researching and planning for 7 of the 15 linkages; San Diego State University Field Station Programs, National Park Service, California State

The 15 Priority Linkages

Santa Monica Mountains-Santa Susana Mountains
Santa Susana Mountains-Sierra Madre Mountains
E. Sierra Madre Mountains-W. Sierra Madre Mountains
Sierra Madre Mountains-Sierra Nevada Mountains
San Gabriel Mountains-Castaic Ranges
San Bernardino Mountains-San Gabriel Mountains
San Bernardino Mountains-San Jacinto Mountains
San Bernardino Mountains-Little San Bernardino Mountains
San Bernardino Mountains-Granite Mountains
Santa Ana Mountains-Palomar Ranges
Otay Mountains-Laguna Mountains
Campo Valley-Laguna Mountains
Otay Mountains-Northern Baja
Peninsular Ranges-Anza Borrego
Jacumba Mountains-Sierra Juarez Mountains

Parks, U. S. Forest Service, Santa Monica Mountains Conservancy, Conservation Biology Institute, and The Nature Conservancy have taken the lead on the other 8 linkages. The San Gabriel-Castaic Linkage is one of these 15 linkages, whose protection is crucial to maintaining ecological and evolutionary processes among large blocks of protected habitat within the South Coast Ecoregion.

Ecological Significance of the San Gabriel-Castaic Linkage

The planning area encompasses a unique ecological transition zone between coastal and desert habitats (Figure 3). Coastal sage scrub and chaparral blankets the hillsides in the western part of the planning area, with dense coast live oak woodlands in canyons, and high quality riparian scrub and woodlands at lower elevations. The easternmost part of the linkage has a strong desert influence; dominated by desert scrub, with scattered juniper and Joshua tree woodlands. A number of sensitive natural communities occur in the planning area including alluvial fan sage scrub, southern cottonwood willow riparian forest, southern riparian scrub, southern sycamore alder riparian, freshwater marsh, coast live oak riparian forest, vernal pool, mainland holly-leaved cherry woodland, valley needlegrass grassland, and coastal sage scrub. These habitats are among the rarest and most sensitive ecosystem types in the United States.

The Santa Clara River is a prominent feature of the linkage, draining 3108 km² (1200 mi²) of the San Gabriel, Castaic, Santa Susana, and Sierra Madre mountains and cutting transversely through the linkage to a large estuary at the coast. As one of the last free flowing natural riparian systems left in southern California, the Santa Clara River supports a diversity of aquatic, semi-aquatic, and terrestrial organisms. The upper watershed and headwater streams in the planning area are largely intact, providing breeding sites, traveling routes, and other resources for wildlife; natural flood control; recharge of groundwater basins; nutrient cycling; and helping to sustain the river and estuary downstream (Meyers et al. 2003). Maintaining and restoring watershed integrity



and habitat connectivity in aquatic and terrestrial systems is essential to sustaining the flow of organisms and processes across the landscape.

Many species that depend on low-elevation habitats are now federally and or state-listed as endangered, threatened, or sensitive, many of which have been recorded or have the potential to occur within the vicinity of the planning area (CDFG 2003). All remaining naturally occurring populations of the endangered Unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*) are in the upper Santa Clara River watershed, in San Francisquito Canyon, Soledad Canyon and Escondido Canyon (Warburton and Fisher 2002). Two other native fish are also present in the planning area; Soledad Canyon is the primary refugia for the federally threatened Santa Ana sucker (*Catostomus santaanae*) and the arroyo chub (*Gila orcutti*) also occurs here. Several listed or sensitive migratory songbirds have the potential to occur, including the endangered southwestern willow flycatcher (*Empidonax traillii extimus*) and least Bell's vireo (*Vireo bellii pusillus*), as well as summer tanager (*Piranga rubra*). The planning area is also home to several listed and sensitive amphibians and reptiles, including the endangered California Red-legged frog (*Rana aurora draytonii*) and arroyo toad (*Bufo microscaphus californicus*), as well as Western spadefoot toad (*Scaphiopus hammondi*), southwestern pond turtle (*Clemmys marmorata*), and San Diego horned lizard (*Phrynosoma coronatum blainvillei*). Species dependent on alluvial fan habitats, such as the federally and state endangered slender-horned spineflower (*Dodecahema leptoceras*) also occur in the planning area. Species restricted to vernal pool habitats, such as the federally endangered Riverside fairy shrimp (*Streptocephalus woottoni*), federally and state endangered California Orcutt grass (*Orcuttia californica*), and federally threatened prostrate navarretia (*Navarretia prostrata*), are also known to occur in the planning area. Species reliant on upland habitats, such as the slender Mariposa lily (*Calochortus clavatus* var *gracilis*), and the federally threatened California gnatcatcher (*Polioptila californica*), also depend on habitat in the linkage. Many recovery plans cite the importance of maintaining habitat in the planning area (USFWS 1993, 1998a, 1998b, 1999, and 2000). In addition to conserving habitat for over a dozen federally or state threatened and endangered species, the linkage provides live-in and move-through habitat for numerous native species that need extensive wildlands to thrive, such as American badger, mule deer, and mountain lion.

Existing Conservation Investments

Significant conservation investments already exist in the region (Figure 4), but the resource values they support could be irreparably harmed by loss of connections between them. This linkage serves to connect two expansive protected core areas. The majority of both the San Gabriel and Castaic ranges are included in the National Forest system, together forming the Angeles National Forest. Designated Wilderness in the San Gabriel Mountains includes the San Gabriel and Sheep Mountain Wilderness Areas, with several other roadless areas proposed for Wilderness status as part of the California Wild Heritage Act (<http://www.californiawild.org>), including two areas contiguous with the southern part of the planning area (i.e., Magic Mountain and Santa Clarita Canyons). And, although no designated Wilderness currently exists in the Castaic Ranges, several worthy areas are proposed including Salt Creek, Fish Canyon, Tule, and Red Mountain. The Liebre Mountain area has also been proposed as a Special Interest Area because of its unique plant associations (Penrod et al. 2002). A relatively modest investment in connective habitats now can help ensure the integrity of these sites in perpetuity.



There is currently a 6 to 10-mile break in connectivity between the Saugus and Tujunga Ranger Districts of the Angeles National Forest, however the landscape still retains high habitat values and opportunities remain for restoring functional habitat connectivity between these significant blocks of public land. Threats to natural habitats in the linkage itself have been recognized by federal, state, and local agencies and non-governmental organizations that have launched a variety of successful planning efforts. As a result, a number of stepping-stones of secured habitat exist in the linkage (Figure 4). The Bureau of Land Management administers land throughout the linkage planning area in Soledad, Long, Bobcat, Young, Hughes, Escondido, Tapie, Tick, and Mint canyons. Los Angeles County manages two natural areas, Vasquez Rocks and Placerita Canyon, and has proposed three Significant Ecological Areas in the linkage planning area (i.e., Santa Clara River, Cruzan Mesa, and Santa Susana/Simi Hills), as part of their General Plan update. The Santa Monica Mountains Conservancy also manages land in the planning area in Towsley, Elsmere and Whitney Canyons. The City of Santa Clarita recently acquired land in Bee Canyon. Finally, the National Park Service recently secured land along the Pacific Crest Trail. The value of already protected land in the region for biodiversity conservation, environmental education, outdoor recreation, and scenic beauty is immense, but it can be irrevocably degraded if these remaining wildlands become disconnected.

Threats to Connectivity

The linkage is imminently threatened by high-density urban development spreading eastward from the City of Santa Clarita, with massive new developments proposed almost weekly. The Santa Clarita area alone is experiencing a growth rate of 3%, the fastest in Los Angeles County among cities with population of 150,000 or more. The population of the City of Santa Clarita is approximately 158,000, while the population of the Santa Clarita Valley, which includes the planning area, exceeds 200,000. While the population of the City of Santa Clarita is anticipated to hit 175,000 by 2008, the larger Santa Clarita Valley is projected at 240,000 by 2010, and over 350,000 by 2025. Rural residential development in the communities of Aqua Dulce and Acton has also created choke points to wildlife movement, though these areas remain somewhat permeable. However, groundwater extraction in these rural communities creates additional obstacles to movement, especially for aquatic and semi aquatic organisms that rely on surface water and well-developed riparian vegetation.

Aggregate mining in and adjacent to the Santa Clara River in Soledad Canyon has already had tremendous impacts on the natural resources of the watershed. The existing mining lease is to be terminated within the next decade and the habitat restored to a semblance of its former grandeur. However, another massive mining project has been proposed in the linkage planning area that would extract 78 million tons of sand and gravel over the next 20 years; the project is currently in litigation. Fortunately, legislation has been introduced by U.S. Senator Barbara Boxer that would terminate two mining leases in Soledad Canyon and prohibit the issuance of any future mining leases for sand and gravel in Soledad Canyon. Congressman Buck McKeon introduced the House version of this bill (H.R. 3529). The City of Santa Clarita recently purchased this property, though not the mineral rights, to bolster their chances of stopping this project in order to protect residents from further degradation of air and water quality and increased traffic congestion.



It has been estimated that over 90% of the historic riparian habitat in Southern California has been eliminated (Dennis et al. 1984, Bell 1997). In Los Angeles County, over 97% of the wetlands once present are now gone, and the wetland and riparian communities remaining are intensely threatened. This significant loss of habitat has been accompanied by a decline in wildlife populations that depend wholly or in part on riparian systems. Whereas millions of dollars are being spent to restore the Los Angeles and San Gabriel Rivers, which are lined with concrete from the mountains to the sea; the Santa Clara River is still wild, supporting a diversity of species, and providing a multitude of ecosystem services that should be maintained.

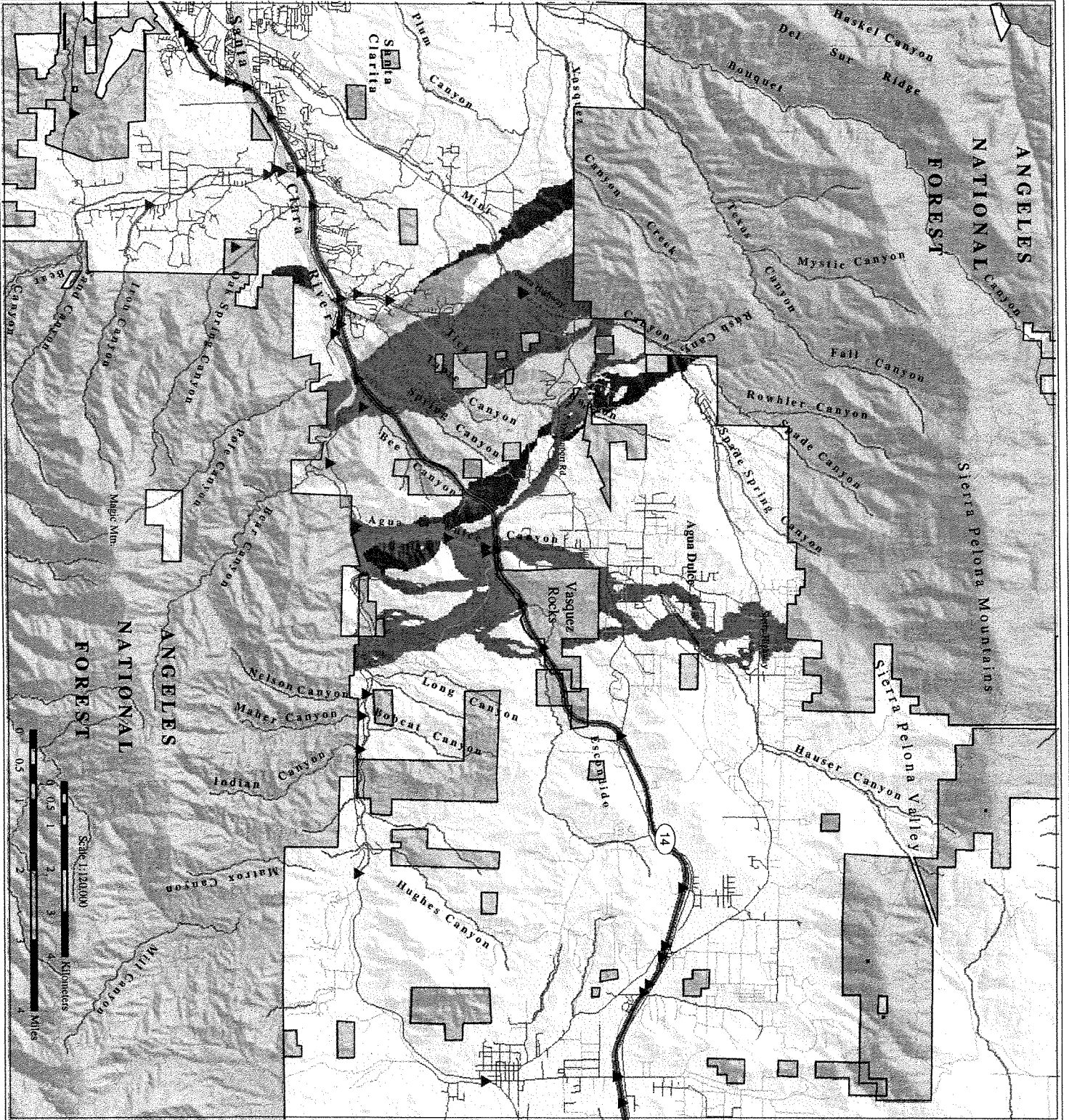
A major transportation route is also proposed in the linkage planning area that would create an enormous barrier to wildlife movement. The California High-Speed Rail Authority has proposed a 200 mph bullet train that would connect major cities throughout the state (<http://www.cahighspeedrail.ca.gov/eir/>). The proposed alignment in the planning area is mostly at grade, and runs from Palmdale, through Soledad Canyon along the Santa Clara River to Interstate 5. The Draft Environmental Impact Report/Environmental Impact Statement calls for high frequency intercity routes, with between 12-20 trains per day. By 2020, they expect 86 weekday trains in each direction, 64 statewide from north to south, and 22 shorter distance routes. Wildlife movement would be further restricted since the railroad rights-of-way would be fenced, not to mention the impacts on species caused by noise and vibration.

Southern California's remaining wildlands form an archipelago of natural open space thrust into one of the world's largest metropolitan area within a global hotspot of biological diversity. These wild areas are naturally interconnected; indeed, they historically functioned as one ecological system. However, recent intensive and unsustainable activities threaten to sever natural connections, forever altering the functional integrity of this remarkable natural system. The ecological, educational, recreational, and spiritual impacts of such a severance would be substantial. Certainly, time is of the essence if we are to secure this regionally important landscape connection.



Figure 9.
Least Cost Union
(Species Overlap)

- Legend**
- American badger
 - Mule deer
 - Mountain lion
 - California spotted owl
 - Pacific kangaroo rat
 - Potential Crossings Structures
 - Highway
 - Paved Roads
 - Dirt Roads
 - Hydrography
 - Ownership Boundaries



Executive Summary - 1.
Linkage Design

Legend

Linkage Design

▲ Potential Crossings Structures

-- Pacific Crest Trail

— Highway

— Paved Roads

— Dirt Roads

— Hydrography

Ownership Boundaries



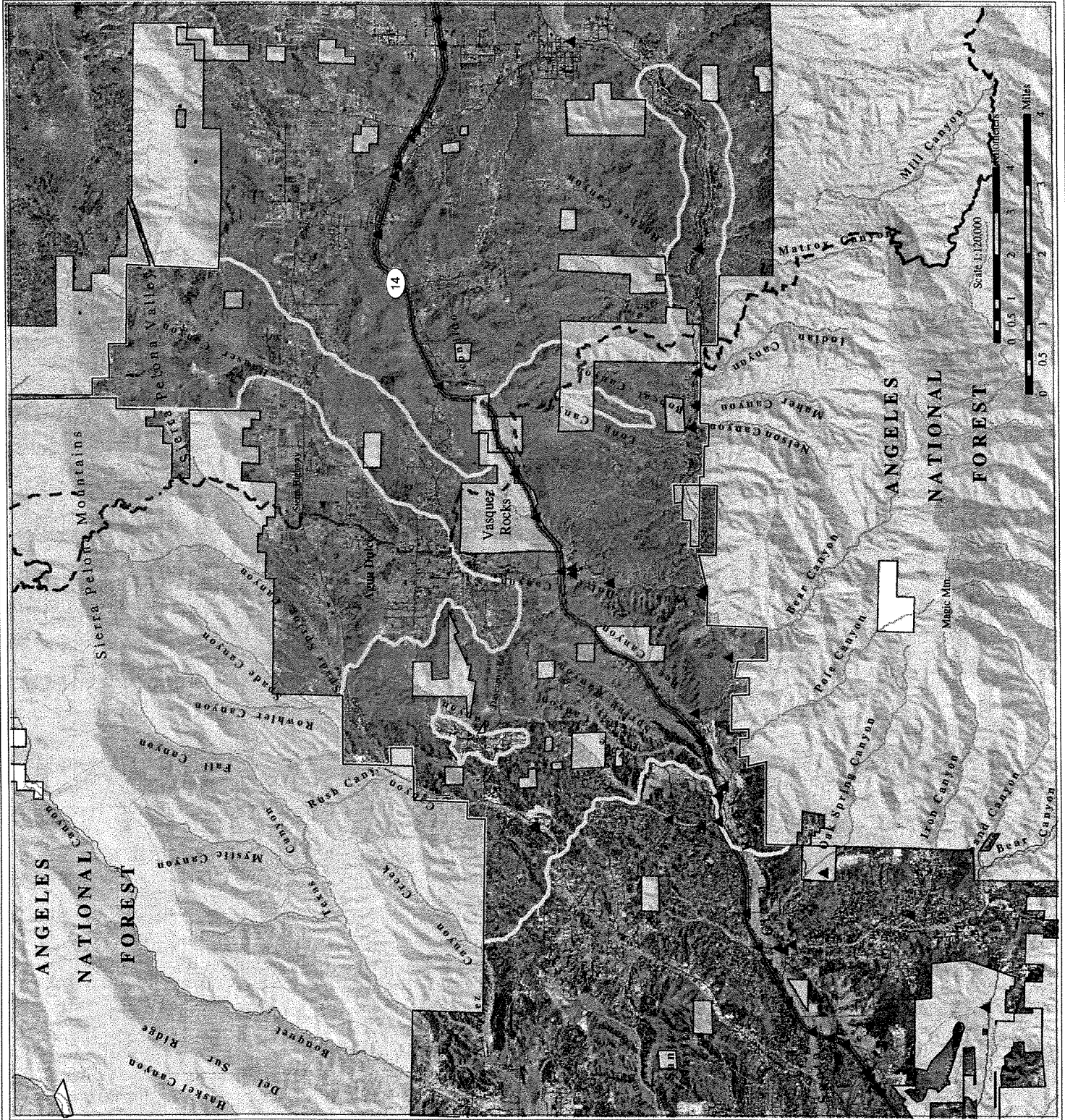
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This chapter is the heart of the report. In it, we summarize the goals of the Linkage Design, present a map of the Linkage Design, and describe the land included in it. However, conserving a linkage is more complex than circumscribing the important acres on a map. While developing the Linkage Design, we conducted field work to identify barriers to movement or land use practices that may prevent species from moving through the linkage. The bulk of this chapter is a description of the existing barriers and prescriptions for actions needed to ensure that the Linkage Design is effective.

Goals of the Linkage Design

To accommodate the range of species and ecosystem functions it is intended to serve, the Linkage Design (Figure 41) attempts to: 1) provide live-in and move-through habitat for multiple species; 2) support metapopulations of smaller species; 3) ensure the availability of key resources; 4) buffer against edge effects; 5) reduce contaminants in streams; 6) allow natural processes to operate with minimal constraints from adjacent urban areas; and 7) allow species and natural communities to respond to climatic changes. To help the reader appreciate why the linkage encompasses such a large area, we elaborate on these seven goals in the following several paragraphs.

The Linkage Design must be wide enough to provide live-in habitat for species with dispersal distances too short to allow movement through the entire length of the Least-Cost Union. Harrison (1992) proposed a minimum corridor width for a species living in a linkage as the width of one individual's territory (assuming territory width is half its length). Thus, our minimum corridor width of 2 km should accommodate species with home ranges of up to 8 km² (3 mi²). This would accommodate all focal species except mountain lion, as well as larger non-focal species such as bobcats. Fortunately, because they can move long distances in a single night, mountain lions do not need live-in habitat throughout the Linkage, and should be able to move through the Linkage Design.

The Linkage Design must support metapopulations of less vagile species. Many small animals, such as salamanders and turtles, require dozens of generations to move between Core Areas. These species need a linkage wide enough to support a constellation of metapopulations, with movements among subpopulations, over decades. Although there are no estimates of widths needed to support metapopulations of any species, 2 km is probably adequate for most species, although it may be narrow for species with little suitable habitat in the linkage.

The Linkage Design is expected to ensure the availability of key resources for all species of native plants and animals, including host plants (e.g., for butterflies), pollinators, predator-free areas, or other elements. For example, many species commonly found in riparian areas depend on upland habitats during some portion of their cycle. These species include butterflies that use larval host plants in upland areas and drink from water sources as adult, western pond turtles that live most of their lives in water but lay their eggs in sandy upland habitats, and western toads that spend the summer in upland burrows but return to the water to breed. In addition, most fish feed on the aquatic larvae of insects, many of which depend on terrestrial habitats as adults. Although the width of upland habitats needed beyond the streams edge has rarely been estimated for these



species, information on the western pond turtle suggests that a 1-km (0.6-mi) upland buffer (i.e., 0.5 km to either side of the stream) (Holland 1991) is needed to sustain populations.

The Linkage was designed to buffer against edge effects even after adjacent land is converted to urban and suburban uses. Human activities in neighboring areas can have undesirable effects on protected areas. These "edge effects" include artificial night lighting, predation by species supported by human activities (e.g., pets, released pets, and native predators such as raccoons that reach high density due to availability of garbage), elevated soil moisture and stream flow from irrigation, pesticides & pollutants, noise, hobby animals that increase risk of interactions with native predators, and removal of natural vegetation. Edge effects (Murcia 1995) have been best-studied at the edge between forests and adjacent agricultural landscapes, where negative effects extend 300 m (980 ft) or more into the forest (Debinski and Holt 2000) depending on forest type, years since the edge was created, and other factors (Norton 2002). The best available data on edge effects for southern California habitats include: reduction in leaf-litter and declines in populations of some species of birds and mammals up to 250 m (800 ft) in coastal scrub (Kristan et al. 2003), collapse of native ant population due the invasion of argentine ants up to 200 m (650 ft) from irrigated areas (Suarez et al. 1998), and predation by pet cats which decimate small vertebrate populations (Churcher and Lawton 1987, Hall et al. 2000) 100 m (300 ft) from the edge (K. Crooks, unpublished data). Domestic cats may affect wildlife up to 300 m (980 ft) from the edge based on home range sizes reported by Hall et al. (2000). In addition, homeowners may clear vegetation up to 61 m (200 ft) around their homes to reduce fire risk and meet insurance requirements at the wildland-urban interface (Longcore 2000).

In areas of the Linkage with streams, upland habitat protection is needed to prevent the degradation of aquatic habitat quality. Contaminants, sediments, and nutrients can reach streams from distances greater than 1 km (0.6 mi) (Maret and MacCoy 2002, Scott 2002, Naicker et al. 2003), and fish, amphibians, and aquatic invertebrates often are more sensitive to land use at watershed scales than at the scale of narrow riparian buffers (Goforth 2000, Fitzpatrick et al. 2001, Stewart et al. 2001, Wang et al. 2001, Scott 2002, Willson and Dorcas 2003).

The Linkage Design must allow natural processes of disturbance and subsequent recruitment to operate with minimal constraints from adjacent urban areas. Linkage width should be sufficient such that the temporary devastation caused by fires, floods and other natural processes does not affect all habitats in the linkage simultaneously. Fire as a natural process is especially challenging to sustain in a relatively small linkage area. Large fires, such as those occurring under Santa Ana wind conditions, could easily burn all habitats in the Least-Cost Union. Before human occupation, naturally occurring fires (due to lightning strikes) were relatively rare in the coastal ranges of southern California (Radtke 1983). As populations in the region soared, fire frequency has also increased dramatically (Keeley and Fotheringham 2000). Homeowners at the wildland-urban interface, alarmed by the devastation of these wildland fires are further promoting the use of prescribed burns to reduce fuels in surrounding natural areas. Although fire has been shown to reduce the occurrence of exotic species in native grasslands (Teresa and Pace 1996), in shrublands it has the opposite effect (Giessow and Zedler 1996), encouraging the invasion of non-native plants. While the pattern of disturbance caused



by this altered fire regime is unpredictable, wider linkages with broader natural communities may be more robust to these disturbances.

The Linkage Design must also allow species to respond to climate change. Over the past century, the earth's warming rate has increased four-fold, and predictions for changes in California's weather include warmer winters with increases in flooding and fire (Field et al. 1999). Plant and animal distributions are predicted to change with the climate, expanding and contracting and rising and falling in elevation (Field et al. 1999). The Linkage width must be broad enough to allow for these wholesale movements in natural communities, and should encompass a diversity of microhabitats (e.g., slopes, aspects, elevations, and soil types) that allow species to colonize new areas.

Description of the Linkage Design

The final Linkage Design has several branches to accommodate diverse species and ecosystem functions (Figure 41). The northwest branch is dominated by coastal sage scrub and chaparral and encompasses all or portions of Bee, Spring, Tapie, Tick, and Mint Canyons (Figure 42). It serves most of the focal species, including puma, mule deer, Pacific kangaroo rat, and California thrasher. The eastern branch connects a series of desert scrub and juniper woodland habitats (Figure 43), thereby linking habitat for species such as American badger, Burrowing owl, and Bear sphinx moth that prefer the open habitats that are prevalent in desert plant communities. The third distinct branch of the Linkage Design follows the Santa Clara River and Soledad Canyon and provides large stepping-stones of habitat for semi-aquatic species, such as the western pond turtle, two-striped garter snake, and mountain kingsnake; it also serves a suite of aquatic and riparian-dependent species (e.g., Unarmored three-spine stickleback, Santa Ana Sucker, Arroyo chub, California red-legged frog, Arroyo toad), not addressed by our analyses.

Although the three branches described above resulted from our modeling efforts, participants in the September 30, 2002, Biological Foundations Workshop, anticipated their existence. It was a common perception amongst biologists familiar with this region that the needs of coastal, desert, and aquatic species would not be met by a simple linear linkage design. This has been substantiated by our analyses.

As expected in this unique ecological transition zone, the Linkage Design encompasses a diversity of natural communities, including 15 different major vegetation types (Table 3). Although natural vegetation comprises most of the Linkage Design, agriculture and urban development cover roughly 3% of its area. Approximately 12% (2,772 out of 23,947 total acres) of the Linkage Design currently enjoys some level of conservation protection, mostly in BLM parcels and Vasquez Rocks County Park.

Coastal, desert, and riparian habitats within the linkage are similar to those found in the two Core Areas. Coastal scrub, chaparral, desert scrub, and juniper woodland communities predominate. Chaparral is the dominant plant community in both core areas, with coastal sage scrub at lower elevations on south-facing slopes, pinyon-juniper woodlands on desert slopes, and montane hardwood and hardwood conifer habitats at higher elevations. Riparian habitats occupy roughly 3% of the Linkage Design. Coast live oak and Valley foothill riparian vegetation occurs along Soledad Canyon and drainages flowing from the San Gabriel Mountains, while alluvial fan sage scrub



occupies Bee Canyon. Coastal Sage Scrub is the primary habitat in the western part of the linkage, extending through Bee, Spring, Tapie, Tick, and Mint canyons. Desert scrub and juniper woodland community connections occur primarily east of Agua Dulce Canyon from below SR-14 to the Sierra Pelona Valley.

Table 3. Approximate Vegetation and Land Cover in the Linkage		
Vegetation Type	Hectares	Acres
Water 0.001%	1.8	4.5
Pinyon-Juniper Woodland 0.004%	4.4	11.0
Agriculture 0.01%	11.9	29.4
Montane Riparian 0.02%	18.9	46.7
Coastal Oak Woodland 0.05%	52.3	129.2
Desert Wash 0.05%	56.5	139.7
Sagebrush 1.1%	108.7	268.7
Annual Grassland 1.3%	127.1	314.0
Barren 1.6%	163.2	403.2
Valley Foothill Riparian 1.7%	168.1	415.4
Urban 3%	321.3	794.0
Juniper 3.8%	373.0	921.6
Chamise-Redshank Chaparral 4%	385.2	951.9
Mixed Chaparral 17%	1660.0	4101.9
Desert Scrub 30%	2936.7	7256.7
Coastal Scrub 34%	3301.9	8159.2
Total	9,691	23,947

Removing and Mitigating Barriers to Movement

Five types of features impede species movements through the Linkage: roads, railroads, impediments to stream flow, industrial operations, and rural residential development. Although these comprise only a small portion of the Linkage Design area, their adverse effects on species movements are disproportionately large, and ameliorating them is essential to maintain or restore functional linkages. This section describes these impediments and suggests where and how their effects may be mitigated to improve linkage function.

This discussion focuses on structures to facilitate movement of terrestrial species across roads, and on structures to facilitate stream flow under roads. Although some documents refer to such structures as "corridors" or even "linkages," we use these terms in their original sense to describe the entire area required to link the landscape and facilitate movement between large protected core areas. Crossing structures represent only small portions, or choke points, within an overall habitat linkage or movement corridor. Investing in specific crossing structures may be meaningless if other essential components of the linkage are left unprotected. Thus it is essential to keep the larger landscape context in mind when discussing existing or proposed structures to cross movement barriers. This broader context also allows awareness of a wider variety of restoration options for maintaining functional linkages. Despite the necessary emphasis



on crossing structures in this section, we urge the reader keep sight of the primary goal of conserving landscape linkages to promote movement between core areas over broad spatial and temporal scales.

Roads as Barriers to Upland Movement: Wildland fragmentation by roads is increasingly recognized as one of the greatest threats to biodiversity (Forman et al. 2003, Trombulak and Frissell 2000, Forman and Deblinger 2000, Jones et al. 2000, Reijnen et al. 1997, Noss 1983, Harris 1984, Wilcox and Murphy 1985, Wilcove et al. 1986, Noss 1987). Roads cause fragmentation by killing animals in vehicle collisions, by creating discontinuities in natural vegetation (the road itself and induced urbanization), by altering animal behavior (noise, artificial light, human activity), by promoting invasion of exotic species, and by degrading the chemical environment (Lyon 1983, Noss and Cooperrider 1994, Forman 1998). Roads present semi-permeable to impermeable barriers for non-flying animals (e.g., insects, fish, amphibians, reptiles, and mammals) and even some flying species (e.g., butterflies and low-flying birds). The genetic isolation of populations caused by roads is an increasing cause of concern. For example, Ernest (2003) documented little flow of mountain lion genes between the Santa Ana and Palomar ranges (where I-15 is the most obvious barrier), and between the Sierra Madre and Sierra Nevada (where I-5, and urbanization along SR-58, are the most obvious barriers). Fragmentation by roads increases inbreeding and genetic drift, potentially contributing to extinction of local populations.

The impact of a road on animal movement varies with species (e.g., the same freeway would have different impact on ground beetles, coyotes, or birds), context (vegetation and topography near the road), and road type and level of traffic (Clevenger et al. 2001). For example, a road on a stream terrace can cause significant population declines in slow-moving amphibians approaching breeding ponds (Stephenson and Calcarone 1999), but a similar road on a ridgeline would have negligible impact on the population. Virtually all documented impacts on animal movement concern paved roads; dirt roads are of less concern and may even facilitate movement of some species (Dickson et al. 2004).

Roads in the Linkage Design: At the time of this report, there are 118 km (73 mi) of paved roads in the Linkage Design area. Two of these roads (i.e., SR-14 and Sierra Highway) are major transportation routes and pose the greatest barriers to wildlife movement. By far the largest of these impediments is SR-14, which bisects the southern part of the linkage for a distance of 13 km (8 mi). A survey of these roads found a variety of bridges, culverts, and drainage pipes that might be useful for implementing road mitigation projects (Figure 44).



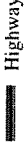
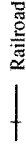
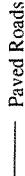
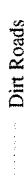
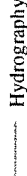
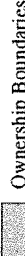
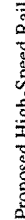
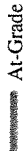
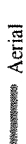
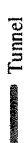
Table 4. Major transportation routes in the Linkage Design.

Road Name	Length (km)	Length (mi)
State Route 14	13	8
Sierra Highway	7	4
Soledad Canyon Road	18	11
Davenport Road	3	2
Other Paved Roads	36	23
Total Length of Paved Roads	118	73



Figure 44.
Existing & Proposed
Infrastructure
in the Planning Area

Legend

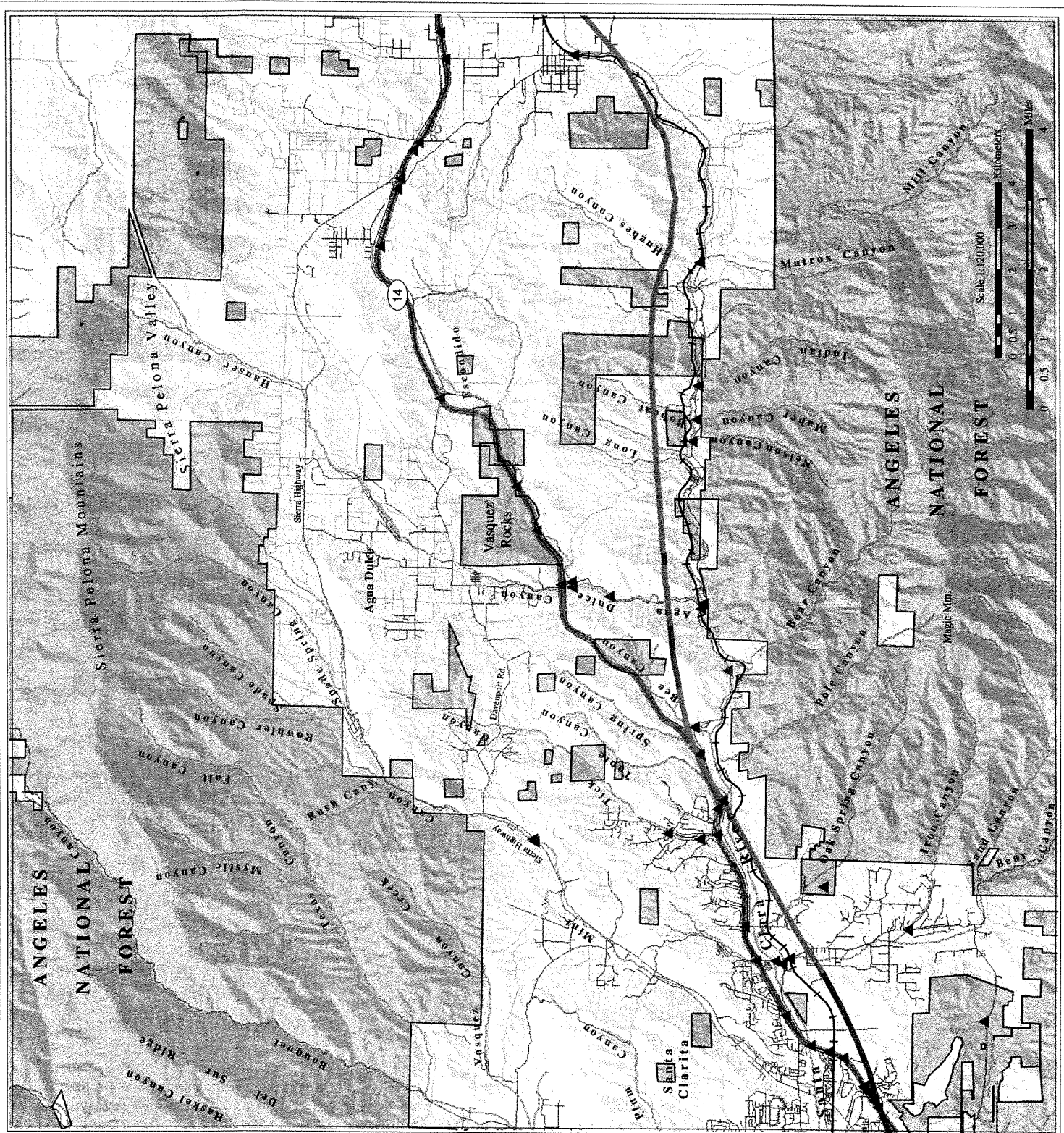
-  Linkage Design
-  Potential Crossings Structures
-  Highway
-  Railroad
-  Paved Roads
-  Dirt Roads
-  Hydrography
-  Ownership Boundaries
-  Proposed High-Speed Rail
 -  At-Grade
 -  Aerial
 -  Tunnel



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Types of Mitigation for Roads: Forman et al. (2003) suggest several ways to mitigate the ecological impact of roads on landscape linkages by creating wildlife crossing structures and reducing traffic noise and light, especially at entrances to crossing structures. Wildlife crossing structures have been successful both in the United States and in other countries (Transportation Research Board 2002), and include underpasses, culverts, bridges, and bridged overcrossings. Most structures were initially built to accommodate streamflow, but have been documented to be useful for wildlife movement. Research and monitoring have confirmed the value of these structures in facilitating wildlife movement. The main types of structures, from most to least effective, are vegetated land-bridges, bridges, underpasses, and culverts.

There are about 50 vegetated wildlife overpasses (Figure 45) in Europe, Canada, Florida, Hawaii, New Jersey, and Utah (Evink 2002, Forman et al. 2003). They range in width from 50 m (164 ft) to more than 200 m wide (656 ft) (Forman et al. 2003). Soil depth ranges from 0.5 to 2 m, allowing for the development of herbaceous, shrub and tree cover (Jackson and Griffin 2000). Wildlife fencing is necessary to funnel animals towards passageways and away from roads (Falk et al. 1978, Ludwig and Bremicker 1983, Feldhammer et al.

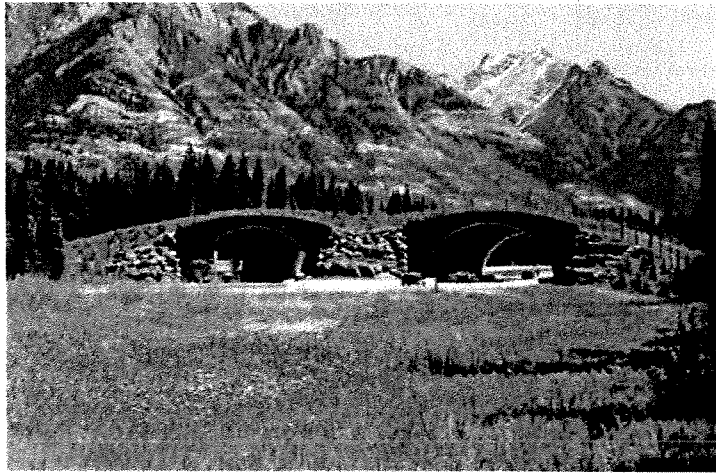


Figure 45. An example of a vegetated land bridge built to enhance movement of wildlife populations. Photo by David Poulton.

1986, Forman et al. 2003). Earthen one-way ramps can allow animals that wander into the right of way to escape over the fence (Bekker et al. 1995, Rosell Papes and Velasco Rivas 1999, Forman et al. 2003). Habitat connectivity can be enhanced for small ground-dwelling animals by ensuring contiguous vegetation, or by placing branches, logs, and other cover along the overpass (Forman et al. 2003). Overpasses maintain ambient conditions of rainfall, temperature, light, vegetation, and cover, and are quieter than underpasses (Jackson and Griffin 2000). In Banff, large mammals preferred overpasses to other crossing structures (Forman et al. 2003). Similarly, birds associated with woodland habitats used overpasses significantly more than they did open areas without an overpass. Other research indicates overpasses may encourage birds and butterflies to cross roads (Forman et al. 2003).

Bridges over waterways should be wide enough to permit growth of both riparian and upland vegetation along both stream banks (Forman et al. 2003, Evink 2002, Jackson and Griffin 2000). The extended bridge is the most successful and cost-effective means of providing connectivity (Evink 2002). Bridges with greater openness ratios are generally more successful than low bridges and culverts (Veenbaas and Brandjes 1999, Jackson and Griffin 2000). The best bridges, termed *viaducts* (Figure 46), are elevated roadways that span entire wetlands, valleys, or gorges, but are cost-effective only where topographic relief is sufficient to accommodate the structure (Evink 2002).



Although inferior to bridges for most species, culverts are also effective (Jackson and Griffin 2000). For carnivores and other large mammals, large culverts (Figure 47) are most effective, and natural earthen substrate flooring is preferable to concrete or metal (Evink 2002). Gloyne and Clevenger (2001) suggest that underpasses for ungulates should be at least 4.27 m in height and 8 m wide, with an openness ratio of 0.9 (openness ratio=height x width/length). Noise, artificial night lighting, and other human activity can deter animal use of a passageway (Yanes et al. 1995, Pfister et al. 1997, Clevenger and Waltho 2000, Forman et al. 2003), and noise can deter animal passage (Forman et al. 2003). Shrub or tree cover should occur near the entrance to the crossing structure (Evink 2002). Existing structures can be substantially improved with little investment by installing wildlife fencing, earthen berms, and vegetation to direct animals to passageways (Forman et al. 2003).

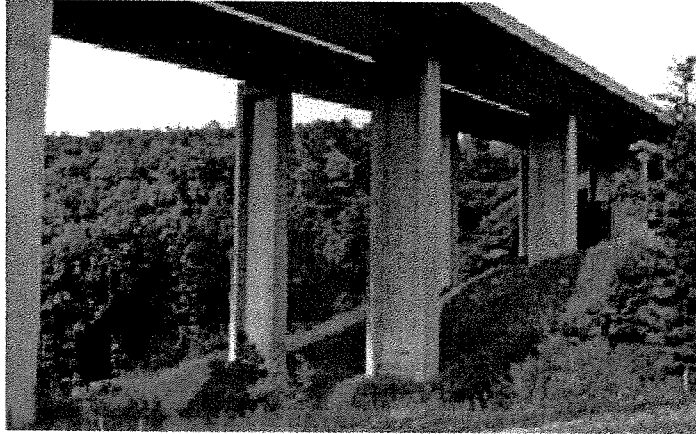


Figure 46. A viaduct in Slovenia built to accommodate wildlife, hydrology, and human connectivity.

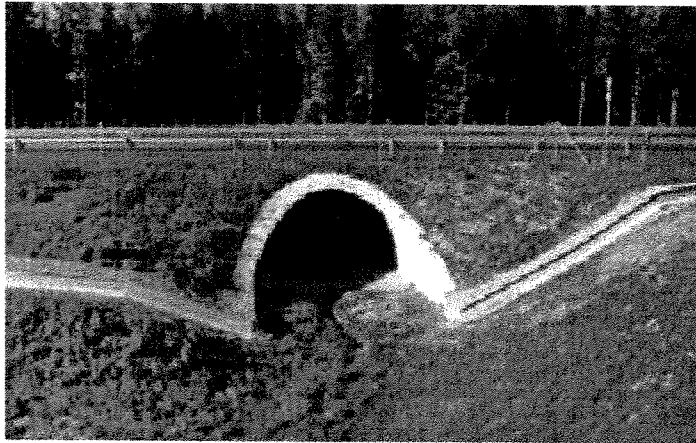


Figure 47. Arched culvert on German highway, with rail for amphibians and fence for larger animals.

For rodents, pipe culverts (Figure 48), about 1 ft in diameter without standing water are superior to large, hard-bottomed culverts, apparently because the overhead cover makes them feel secure against predators (Forman et al. 2003, Clevenger et al. 2001). In places where a bridged, vegetated undercrossing or overcrossing is not feasible, placing pipe culverts alongside box culverts can help serve movement needs of both small and large animals. Special crossing structures that allow light and water to enter the structure have been designed to accommodate amphibians (Figure 49). Short retaining walls should be installed, where necessary, along paved roads to deter small mammals, amphibians, and reptiles from accessing roadways (Jackson and Griffin 2000). Concrete retaining walls are relatively maintenance free, and a great deal better than wire mesh, which must be buried and regularly maintained.





Figure 48. Pipe culvert designed to accommodate small mammals.

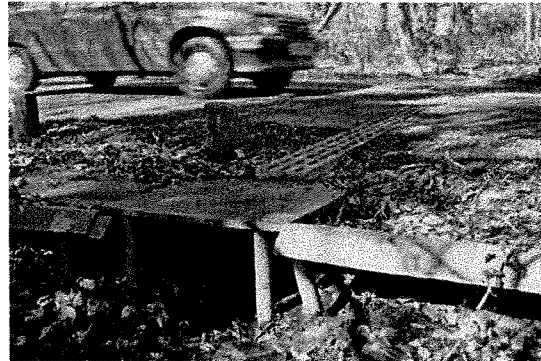


Figure 49. Amphibian tunnels allow light and moisture into the structure.

Recommended Locations for Crossing Structures on State Route 14: State Route 14 is the most substantial impediment to movement within the Linkage Design. It bisects the southern part of the linkage for 13 km (8 mi) and currently lacks adequate crossing structures (Figure 44). Given the continental importance of this linkage, we have identified four locations at which first-class crossing structures should be located. At each of these locations, we recommend ample bridged undercrossings large enough to allow natural vegetation to grow throughout the structure.

1. Near the confluence of Spring Canyon, Bee Canyon, and the Santa Clara River.

The least cost corridors for puma, badger, mule deer, and Pacific kangaroo rat cross the freeway here, and appropriate habitats for California thrasher and Burrowing owl also occur along this part of freeway. Natural habitat abuts the freeway in most of this area. Finally, this area offers maximum continuity for coastal sage scrub along SR-14, and thus would best serve the needs of most species associated with coastal sage, including species that were not used in our permeability analyses. This is the last opportunity to ensure a connection of coastal habitats between the San Gabriel and Castaic Ranges.

The bridged underpass for Spring Canyon Road (Figure 50) is inadequate to accommodate species movement. The existing structure is not accessible to an animal in the Santa Clara River, due to the steep fill slope for Soledad Canyon Road (Figure 50). Although somewhat more permeable in the southbound direction, the steep drop off and lack of natural vegetation on the south side of the freeway, asphalt pavement in the 2-lane underpass, and the mining operation in the Santa Clara River make it unlikely that this structure and the surrounding habitat can be restored to provide meaningful connectivity in the foreseeable future.

We recommend a new bridge about 400 m east of the existing underpass, and redirecting the main channel of Spring Canyon under this new bridge, so that Spring Canyon would join Bee Canyon just south of SR-14, near the Santa Clara River (Figure 51). The new bridge would replace a section of fill slope along the low ridge between lower Spring and Bee Canyons (Figure 51). We also recommend enhancement of the vegetation underneath and approaching the bridge. This design would be the only location in which a long and essentially undisturbed canyon (Spring Canyon) would funnel animals toward a SR-14 underpass from the north. The south side of the freeway is close to both riparian and upland habitats, and away from the gravel mine.



2. Agua Dulce Creek. At present Agua Dulce Creek passes under SR-14 via an oversized concrete pipe culvert (Figure 52), with concrete flooring, poor visibility to the other side, and no vegetation in the structure, reducing the likelihood for plant and animal movement. South of SR-14, the riparian vegetation is well developed with cottonwoods, sycamores, and willows, and no significant riparian or upland impediments between SR-14 and Soledad Canyon (and the Angeles NF boundary) about 2 miles to the south. Immediately north of the freeway, the riparian vegetation is much reduced, and the town of Agua Dulce lies about 1 mile north, impeding meaningful riparian connectivity at this time. About a dozen homes along Agua Dulce Road between SR-14 and the town of Agua Dulce are probably compatible with linkage function. The least cost path of Badger crosses SR-14 here, and suitable habitat for several semiaquatic focal species, such as pond turtle, two-striped garter snake, and kingsnake, occurs in this area. To maximize the utility of Agua Dulce Creek as a movement area, we recommend removing the fill slope under SR-14 and upgrading the existing vehicle underpass to a bridged undercrossing that spans the canyon. Improving this structure could help animals get to Vasquez Rocks or funnel them toward the middle branch of the Linkage Design to Spring, Tapie, and Tick Canyons.

3 & 4. Escondido Creek. Escondido Creek crosses SR-14 twice in less than a mile, in the transition zone between coastal and desert scrub habitats. Vasquez Rocks County Park lies on the north side of SR-14 at both crossings. The riparian vegetation of Escondido Creek is lush, with mature Sycamores and willows. Least cost paths of American badger cross SR-14 in this area, which also provides the best habitat connectivity for Bear sphinx moth and several semiaquatic species. The extensive desert scrub in upland areas suggests it would be useful for a number of species

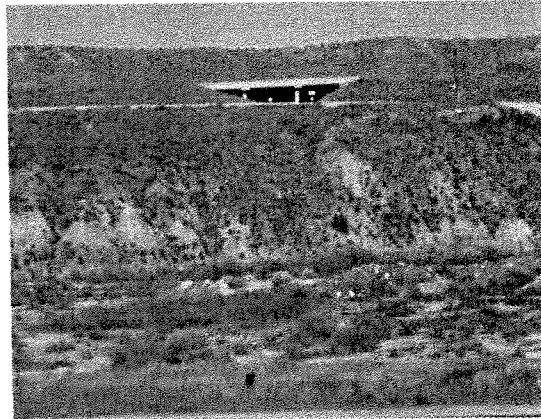


Figure 50. The existing Spring Canyon road underpass is not accessible to an animal in the Santa Clara River.

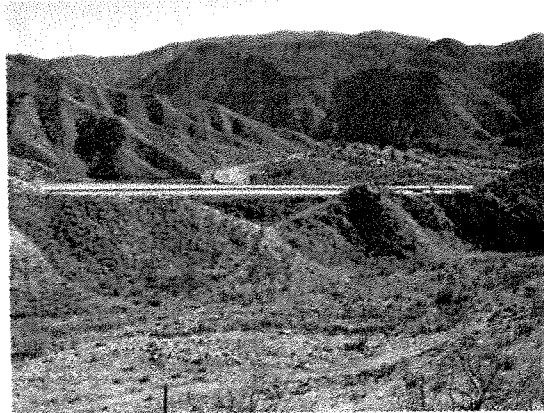


Figure 51. Removing the fill slope under SR-14 would route Spring Canyon to Bee Canyon and the Santa Clara River.

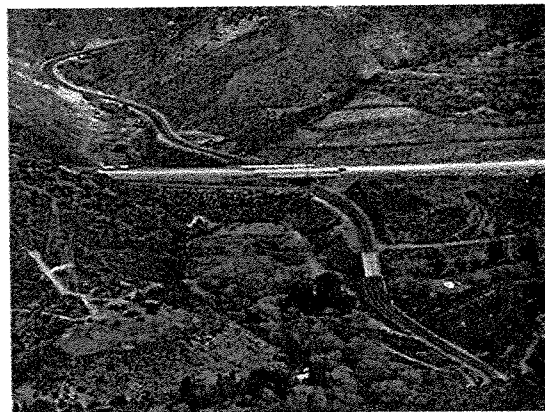


Figure 52. Agua Dulce Canyon vehicle underpass, with drainage culvert for stream visible to the left of the underpass.



associated with desert habitats whose needs we did not analyze. The western existing structure is a long concrete box at the bottom of a deep fill slope, with concrete flooring, poor visibility, and no vegetation in the structure. We recommend replacing the fill slope and culvert with a bridge. The Pacific Crest Trail runs through the eastern box culvert; the fill slope and culvert at this location should also be replaced with a bridge. Although the land south of the freeway at the eastern crossing is in private ownership, steep slopes, poorly consolidated soils, and seismic constraints may limit its development potential.

Recommended Locations for Crossing Structures on Sierra Highway: The Sierra Highway is a 2-lane road with heavy traffic volumes during rush hour (Figure 44). It is used as a commuter route between Santa Clarita and the communities of Sleepy Valley, Aqua Dulce, and White Heather. Sierra Highway stretches through 7 km (4 mi) of the Linkage Design. Although it doubtless contributes to wildlife mortality and is avoided by most species, it is not presently an impermeable barrier, especially at night. However, if lanes are added wildlife passage should be accommodated via bridged undercrossings that encompass both riparian and upland vegetation within the crossing structure. Three crossing structures should be built (at the time of road upgrading) in the section of Sierra Highway north of The Old Dirt Road and south of the community of Sleepy Valley. The highway runs along Mint Creek, crossing it 5 times in this stretch of road. When the road is upgraded, the number and location of crossings will probably change, but at least 3 crossing structures should be built. One should facilitate movement near the confluence of Rowher Canyon, Rush Canyon, allowing access to Rowher and Rush Canyons from the steep ridges southeast of the Highway. This area is currently in public ownership. The exact location of the other two structures will depend on conservation of the private lands that abut Sierra Highway in the rest of this area. Currently there are few dwellings or significant infrastructure (besides the highway). We recommend maintaining the rural character of the landscape southwest of the village of Sleepy Valley, with appropriate measures to confine light and noise pollution to the vicinity of the village. The second area for which we propose a bridged crossing structure is in the juniper woodlands, between Sierra Vista Drive and Shady Lane, in the eastern branch of the Linkage Design, where Willow Spring Gulch flows under Sierra Highway. There are a few dwellings in this area but they are widely spaced and retain most of the native vegetation. We emphasize that these improvements are not needed until significant road improvements (wide shoulders, realignment, or additional lanes) are undertaken.

Other Recommendations Regarding Paved Roads Within the Linkage Area:

- Consider existing crossing structure as indicators of the approximate location of freeway crossings, not as fixed elements of a Linkage Design.
- Transportation agencies should use each road improvement project as an opportunity to replace fill slopes and pipe culverts with box culverts (large enough to allow a clear view to the other side) or bridges (large enough to allow vegetation to grow). Promote the use of earthen substrate flooring. In locations where a bridge is not feasible and only a culvert can be provided, install a pipe culvert (designed to remain free of water) parallel to the box culvert to provide for passage of small mammals, amphibians, and reptiles.



- Encourage woody vegetation leading up to both sides of crossing structures to provide cover for wildlife and to direct their movement toward the crossing structure (Hunt et al. 1987, Rodriguez et al. 1996, Rosell et al. 1997, Santolini et al. 1997, Linden 1997, Clevenger and Waltho 1999, McDonald and St. Clair 2004). Work with the California Native Plant Society, local Resource Conservation District or other non-profit organization active in restoration efforts in the area to restore riparian communities and vegetative cover at passageways.
- Install appropriate wildlife fencing along the freeway to guide animals to crossing structures and keep them off the highway. Install escape structures, such as earthen ramps, to allow animals to escape if they get trapped on the freeway.
- Use fine mesh fencing to guide amphibians and reptiles to crossing structures.
- On both freeways and other paved roads, minimize artificial night lighting, and direct the light onto the roadway and away from adjacent wildland.

Roads as Ephemeral Barriers: Structures designed for wildlife movement are increasingly common. In southern California, 26 wildlife crossing structures were installed along 22-miles of State Route 58 in the Mohave Desert specifically for desert tortoise movement (Evink 2002). In the South Coast Ecoregion, the Coal Canyon interchange on State Route 91 is now being converted, through a partnership with CalTrans, California State Parks, and Hills for Everyone, from a vehicle interchange into a wildlife underpass to facilitate movement between the Chino Hills and the Santa Ana Mountains. About 8 wildlife underpass bridges and viaducts were installed along State Route 241 in Orange County, although urbanization near this toll road has compromised their utility (Evink 2002). Elsewhere, several crossing structures, including 3 vegetated overpasses, have been built to accommodate movement across the Trans-Canada Highway in Banff National Park (Clevenger et al. 2001). In south Florida, 24 underpasses specifically designed for wildlife were constructed along 64km of Interstate 75 in south Florida in about 1985. The structures are readily used by endangered Florida panthers and bears, and have reduced panther and bear roadkill to zero on that route. Smaller wildlife crossings on State Route 29 in south Florida have proved nearly as effective (Lotz et al. 1996).

Almost all of these structures were designed specifically for wildlife movement along existing highways and were not part of the original road design. This fact demonstrates that the existing low permeability across SR-14 should not be accepted as irreversible. Most importantly, the current lack of permeability should not be used as an excuse to develop lands adjacent to the freeway on the grounds that the freeway is a permanent and absolute barrier. Indeed, at least 2 pumas crossed bustling Interstate-15 near Temecula in the early 1990's (Beier 1996, and unpublished data), and another crossed SR-118 near Simi Valley several times since 2002 (Ray Sauvajot, National Park Service, unpublished data). In contrast to a road, an urban development creates a barrier that cannot be corrected by building crossing structures. Urban and suburban areas make particularly inappropriate landscapes for movement of all large carnivores, most reptiles and amphibians, and many nocturnal small mammals. Thus development along freeways creates significant new and more permanent obstacles to landscape connectivity, above and beyond that presented by a freeway alone.



Representatives from CalTrans have attended each of the four workshops of the South Coast Missing Linkages effort, and the agency is eager to spend its mitigation dollars in the most important linkage areas. For example, CalTrans recently proposed building a wildlife overpass over SR-118, and in February 2003 CalTrans started removing pavement from the Coal Canyon interchange in Orange County and transferred the property to California State Parks expressly to allow wildlife movement between Cleveland National Forest and Chino Hills State Park. In the case of SR-14, improvements may not occur during the next 10-20 years, during which gene flow will continue to be disrupted. However, once connectivity is restored, genomes of all affected species should rapidly recover.

Rail Line Barriers to Movement

Like highways, railroads also can impede plant and animal movement across roads (Messenger 1968, Niemi 1969, Klein 1971, Stapleton and Kiviat 1979, Muehlenbach 1979, Lienenbecker and Raabe 1981, Forman et al. 1995), though there are some differences. Railroads tend to follow straighter lines than roads, trigger more and larger fires, and scatter deleterious particles widely over the land bordering the rail line (Forman and Boerner 1981, Forman et al. 2003). Roadkill rates are likely a great deal lower per train than per vehicle on roads, though trains have been derailed from collisions with large mammals. Grain spilled from trains can attract deer and bears to feed on the rail line; such events have caused significant mortality to grizzly bears in Montana (Federal Register Feb 11 2004, 69: 6683-6685; C. Servheen, University of Montana, personal communication). Freight trains transporting cargo also disperse non-native seeds, insects, and perhaps mammals along railroad networks (Thomson 1940, Stapleton and Kiviat 1979, Forman et al. 2003).

Existing and Proposed Rail Lines in the Linkage Design Area: The main line of the Southern Pacific Railroad has run through Soledad Canyon since 1876. Metrolink currently uses the tracks through Soledad Canyon between the Antelope Valley and Los Angeles with 10 trips in each direction per day, running from 4:00 am to 10:00 pm (Figure 53). The train tracks run parallel to the riverbed and the Angeles National Forest boundary in the Linkage Design area (Figure 44). In highly constricted areas in Soledad Canyon the tracks grasp the side of the canyon, scarcely outside of the riverbed (AMEC 2004). After a century, plants have recolonized cut and fill slopes, the River's braids and meanders have adapted to channel alterations, and mature riparian vegetation has re-established. Thus the railroad's narrow and often gently sloped footprint is probably fairly permeable to movement of plants and some animals (Figure 54).

The California High-Speed Rail Authority has proposed a 200 mph bullet train that would connect major cities throughout the state. The proposed route through the Linkage Design in Soledad Canyon is part of the Bakersfield to Los Angeles route, an alternative route is also being considered that would follow Interstate 5 from Bakersfield through the Tejon Pass. The proposed route through the Linkage Design area would create a barrier to wildlife movement much more severe than the current railroad because (a) the proposed alignment is mostly at-grade in the planning area, (b) the entire ROW would be fenced, (c) there would be massive cut and fill slopes along 30.9 km (19.20 mi) of Soledad Canyon alone, with additional impacts in the Santa Clara River, and (d) by 2020 86 weekday trains will travel 200 mph in each direction, creating 172 noise and vibration events per day.



The Draft Program Environmental Impact Report/Environmental Impact Statement for the project (<http://www.cahighspeedrail.ca.gov/eir/>) only evaluated impacts 0.8 km (0.5 mi) on either side of the proposed rail line, though impacts to existing conservation investments would go far beyond this area. Riparian and aquatic habitat would be seriously impacted by cut and fill slopes. Impacts to jurisdictional waters include loss or alteration of 12.6 ha (31.2 ac) of lacustrine waters, 10.1 ha (25 ac) of palustrine waters, 2.3 ha (5.7 ac) of riverine habitat, and 2.7 km (1.7 mi) of "non-wetland" intermittent streams and 45 m (146 ft) of "non-wetland" perennial streambeds associated with Agua Dulce Canyon Creek, Aliso Canyon Creek, Placerita Creek, and the Santa Clara River.

Recommendations to Mitigate the Effects of Rail Lines in the Linkage Design Area:

We believe that the existing rail line, as currently operated, does not require special mitigation measures. At the time the line is altered, the responsible agencies should use construction as an opportunity to improve wildlife permeability across the railroad.

Mitigating the adverse affects of railroads is similar to that for roads, providing viaducts, bridged underpasses, tunneling, etc. (Reed and Schwarzmeier 1978, Borowske and Heitlinger 1981, Forman et al. 1995).

We recommend that the High Speed Rail project adopt a policy of no net loss of wildland connectivity. It may be impossible to do with the currently proposed alignment in Soledad Canyon. We recommend considering an alternative alignment following SR-14, perhaps in the highway median. By building sound walls to reduce noise and light pollution along the combined rail and road corridor, and sharing the cost of the 4 SR-14 crossing structures recommended above, the project could actually create a net benefit to the utility of the linkage. Transportation agencies could use this as an opportunity to work together to install wildlife-crossing structures (i.e. ecological infrastructure) under SR-14.



Figure 53. Metrolink running through Soledad Canyon, passing through the Santa Clara River.

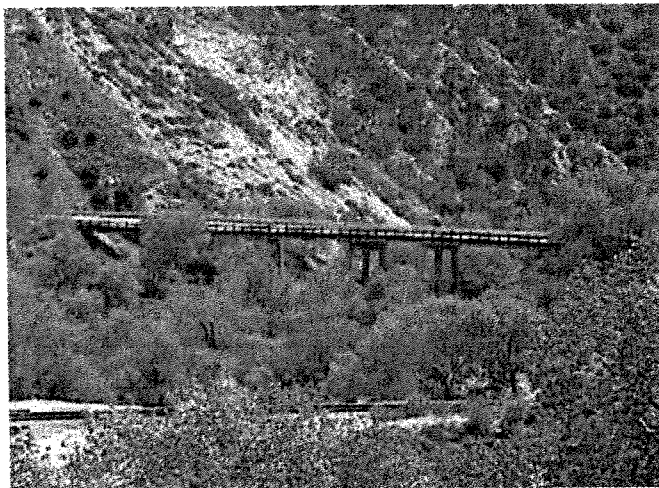


Figure 54. Expanded bridge over Santa Clara River with the railroad in the foreground.



Impediments to Streams

Wetland and riparian habitats occupy less than 1% of the total land area in the western U.S., yet are used by up to 80% of terrestrial vertebrate species (Kreuper 1992). The ninth annual report of the U.S. Council on Environmental Quality (1978) states, "no ecosystem is more essential than the riparian system to the survival of the nation's fish and wildlife" (Horwitz 1978, Faber et al. 1989). Despite their importance to biological communities, over 90% of the historic wetland and riparian vegetation in Southern California has been eliminated or severely altered by urban and agricultural activities (Peters and Noss 1995). Coastal watersheds, in particular, have suffered due to dams, diversions, channelization, development, livestock grazing, and land disturbance (Dennis et al. 1984, Bell 1997). This extensive loss of habitat has resulted in declines in wildlife and plant populations that depend wholly or in part on riparian systems (Faber et al. 1989).

Terrestrial organisms moving through rugged landscapes also often use riparian areas as travel routes. Some invertebrates, such as butterflies, preferentially move through streamside areas (USGS 2002a, Orsack 1977). Some species of frogs are restricted to streamside movements (Kay 1989). Although southwestern pond turtles are capable of overland movements of up to 0.5 km (0.3 mi) (Holland 1991), they preferentially move along stream courses (Bury 1972). Even large, mobile vertebrates, such as mountain lions, have shown preferences for moving through riparian corridors (Beier 1995, Dickson et al. 2004).

For plants and animals associated with streams or riparian areas, impediments are presented by road crossings, exotic species, increased scouring of native vegetation by urban runoff, water recharge basins, dumping and runoff of agricultural waste and fertilizers, farming in streambeds, gravel mining, and concrete structures that stabilize stream banks and streambeds. Increased urban and agricultural runoff also can create permanent streams in areas that were formerly ephemeral; permanent waters can support aggressive invasive species, such as bullfrogs and exotic fish that prey on native aquatic species, and giant reed that supplants native plant communities (Fisher and Crooks 2001).

Impediments to streams in the Linkage Design: The Linkage Design encompasses several connections for semi-aquatic and riparian species. Soledad Canyon (Santa Clara River) is the most prominent riparian feature in the Linkage Design, meandering along the Forest Service boundary in the southern part of the linkage, from Acton west to Pole Canyon. None of the tributaries of the Santa Clara River (Long, Bobcat, Escondido, Agua Dulce, Bee, Spring, Tapie, Tick, and Mint) provides a direct riparian connection between the two Core Areas. Two of these tributaries – Agua Dulce Creek and Mint Creek – historically provided a continuous avenue along which aquatic and semi aquatic species could journey between the San Gabriel and Castaic ranges. Today the lower 3 miles of Mint Canyon are heavily urbanized, and riparian vegetation is absent from over 2 miles of the middle reaches of Agua Dulce Creek within the town of Agua Dulce (Darling Road nearly to Sierra Highway). Although fragmented, the remaining riparian areas are crucial for sustaining populations of water-dependent species (e.g., western pond turtle, two-striped garter snake, mountain kingsnake) in the Linkage Design area, and may function as steppingstones that allow movement by semiaquatic species. The pond turtle, for instance, is known to make overland



movements among drainages (Holland unpubl.). They can also provide travel routes for terrestrial organisms, such as mountain lion, which are known to move along riparian corridors (Spotwart and Samson 1986, Beier and Barrett 1993, Dickson et al. 2004).

The Linkage Design encompasses the headwaters of the Santa Clara River. A number of tributaries drain the San Gabriel Mountains from the Tujunga Ranger District of the Angeles National to the Santa Clara River: Pole, Bear, Nelson, Maher, Indian, Matrox, Mill, and Arrastre creeks. Vegetation along these drainages is a mixture of oak woodland, willow scrub, mulefat, sycamore, and cottonwood depending on the availability of water along these creeks. Tributaries draining the Castaic Ranges from the Saugus Ranger District or originating in the linkage itself include Vasquez, Rowher, Spade, Spade Spring, Mint, Tick, Tapie, Spring, Bee, Agua Dulce, Lettreau, Hauser, Willow Springs, Escondido, Long, and Bobcat creeks. Vegetation along these drainages varies widely, from high quality riparian scrub, woodland, and forests, and alluvial fan sage scrub to areas where riparian vegetation is reduced or absent (i.e., Agua Dulce), due to groundwater pumping or diversions. Riparian and upland vegetation along the river, while spectacular, has also been impacted. There are a number of recreational camps along the river that have greatly altered and infringed upon the stream channel and there is a large mining operation in the riparian zone off of Soledad Canyon Road near SR-14.

Historically runoff from the San Gabriel and Castaic Ranges supported riparian and aquatic habitat along the river and its tributaries. The presence of broad sandy washes suggests that flows may have been seasonal along some stretches but close enough to the surface to sustain riparian vegetation. The continuous stands of sycamore and cottonwood riparian forest, willow woodland and riparian scrub provided avenues for riparian and aquatic species to move between the river and its tributaries. Winter rains likely facilitated fish dispersal and allowed arroyo chub, Santa Ana sucker, and Unarmored three-spine stickleback to move among tributaries and the main stem of the river. Historical records indicate an intermittent flow regime in the mainstem of the river, with seasonal surface flows in years of high precipitation, and infrequent but torrential floods (Schwartzberg and Moore 1995, AMEC 2004).

Ground water pumping has drastically altered the hydrology of the Santa Clara River and its tributaries and has likely triggered a substantial reduction in riparian vegetation. There are a number of wells that extract groundwater from the aquifers at rates greater than 100 gallons per minute and several small volume private wells scattered throughout the planning area. The major water purveyors are Los Angeles County Water Works District, Acton Camp, a trailer park, and a few large private wells installed in the southern part of the Acton Valley Groundwater Basin, with 21 private wells in the Soledad Canyon Alluvial Channel (AMEC 2004). Concerns over groundwater supplies arose as early as the 1920s (Schwartzberg and Moore 1995). Groundwater levels have been declining ever since due to an increase in industrial, commercial and residential uses in conjunction with prolonged drought (AMEC 2004). Groundwater supplies are now at record lows, with several wells in the upper watershed at catastrophically low levels.

Water quality on the main stem and several tributaries has also been impaired. Mint Canyon and several reaches of the Santa Clara River were listed as impaired under Section 303(d) of the Clean Water Act due to excessive total dissolved solids, sulfate and chloride in 2002 (RWQCB). Total dissolved solids are measured as the amount of



material that is dissolved in water and can include carbonate, bicarbonate, chloride, sulfate, phosphate, nitrate, calcium, magnesium, sodium, organic ions, and other ions. These listings make these riparian stretches eligible for the development of intensive management plans called Total Maximum Daily Load (TMDL) plans. TMDLs are implemented by the Regional Water Quality Control Board, which evaluates the cause of water quality deterioration and then enacts an implementation plan to return water quality to targeted values. Other water quality efforts either completed or in progress include development of a chloride TMDL (Total Maximum Daily Load) for the upper reach of the River, a nutrient TMDL, and on-going NPDES permit related monitoring (AMEC 2004).

Examples of Mitigation for Stream Barriers: The primary goal of many restoration projects has been to restore habitat for targeted species; however, few restoration projects have focused on the natural dynamics of the systems on which these species depend (Bell 1997). In riparian systems, annual floods are a major component of ecosystem function. Many riparian plants are considered pioneer species, and have developed adaptations such as rhizomes, stolons, and wind- and water-disseminated seeds, that allow seedlings to become quickly established on newly deposited soils (Ohmart 1994). Because of the adaptation and resilience of riparian plants to high-disturbance regimes such as floods, revegetation can be a natural process if threats (i.e. invasive species) are removed from the system and physical processes are restored (e.g., dams and diversions are mitigated or removed, natural flow regimes restored).

Continuity between upland and riparian vegetation types is also a key component of viable riparian ecosystems. Many species commonly found in riparian areas depend on upland habitats during some portion of their cycle. These species include butterflies that use larval host plants in upland habitat and drink as adults, western pond turtles that lay their eggs in sandy upland habitats, and western toads that summer in upland burrows. Most fish feed on the aquatic larvae of insects that depend on terrestrial habitats as adults. While the width of upland habitats needed beyond the streams edge has rarely been estimated for these species, information on the western pond turtle suggests that a 1-km (0.6-mi) upland buffer (i.e., 0.5 km to either side of the stream) (Holland 1991) is needed to sustain populations of this species.

Conservation measures to minimize the impacts of development on aquatic habitats primarily focus on the use of riparian buffer zones. Regulations exist to limit development along or near streams and rivers (Barton et al. 1985, Allan 1995, Wilson and Dorcas 2003). However, although these buffers are intended to prevent erosion and filter runoff of contaminants (U.S. Environmental Protection Agency), research suggests that current regulations are inadequate to protect populations of semiaquatic reptiles and amphibians. A functional buffer must encompass a sufficient amount of upland habitat to maintain water-quality and habitat characteristics essential to the survival of many aquatic and semiaquatic organisms (Brososke et al. 1997, Wilson and Dorcas 2003). However, maintaining riparian buffers will not suffice for some species, for instance, to preserve salamander populations in headwater streams, land use must be considered at the watershed level (Wilson and Dorcas 2003).

Recommendations to Mitigate the Effects of Streams Barriers in the Linkage Design Area: To enhance species use of riparian habitat and restore riparian connections through the Linkage Design area, we recommend:



- Wherever possible restore the natural historic flow regime or create a regime that provides maximum benefit for native biodiversity. Work with National Marine Fisheries Service, California Department of Fish and Game, Los Angeles County Department of Public Works, Water Districts, watershed groups and others to investigate the historic flow regimes and develop a surface and groundwater management program to restore and recover properly functioning aquatic/riparian conditions based on parameters developed by NFMS (1996).
- Mitigate the effects of road crossings in riparian zones. Coordinate with the California Department of Transportation, National Marine Fisheries Service, and California Department of Fish and Game to evaluate existing stream crossings and upgrade culverts, stream crossings, bridges, and roads that impede movement (USFWS 1998). Use strategies identified in *Guidelines for Salmonid Passage at Stream Crossings* (NFMS 2000), including information on preferred crossings, designing new culverts, retrofitting or replacing culverts, general recommendations, post construction evaluation, maintenance and long term assessment. Install specialized culverts and bridges in streams for improved fish passage to address outfall height, water velocities, and water depth for adequate upstream fish passage (Carey and Wagner 1996, Evink 2002).
- Restore riparian vegetation in all drainages and upland vegetation within 1 km (0.6 mi) of streams and rivers. These areas may restrict plant or animal movements and compromise water quality by increasing erosion and non-point sources of pollution. If restored, these areas would support aquatic and semi-aquatic species and enhance movement through both aquatic and riparian habitats. Discourage the construction of concrete-banked streams and other channelization projects.
- Remove exotic aquatic plants and animals from streams, rivers, and lakes. Work with the Biological Resources Division at USGS, U.S. Forest Service, Bureau of Land Management and other relevant agencies to survey streams and drainages for invasive species and develop a comprehensive removal strategy. The survey and removal should document and recommend how to deal with ephemeral drainages that are becoming increasingly perennial due to urban and agricultural runoff, and supporting exotic fish and bullfrogs.
- Enforce existing regulations protecting streams and stream vegetation from alteration, manure dumping, and vegetation removal. Agencies and regulations with applicable jurisdiction include California Department of Fish and Game, Streambed Alteration Agreements, Army Corps of Engineers, Clean Water Act, Native Plant Protection Act and Oak Tree Ordinances. In high abuse areas, post signs that prevent vehicles from driving in the creek bottom. Review existing regulations relative to linkage goals and develop additional restrictions or recommend closures in sensitive areas.
- Aggressively enforce regulations restricting farming, gravel mining, and building in streams and floodplains.



- Increase and maintain high water quality standards in the Santa Clara Watershed. Work with the Resource Conservation District to help establish use of Best Management Practices for all agricultural operations in the watershed, including alternatives to the standard practices of fertilizer use. Work with Regional Water Quality Control Board and the Total Maximum Daily Load (TMDL) process to reduce nutrient levels in impaired reaches of the watershed.
- Support the protection of riparian and adjacent upland habitats on private lands. Pursue cooperative programs with landowners to improve conditions in riparian and upland habitats on private land in the Linkage Design.

Other Land Uses that impede Utility of the Linkage

Land management policies in the Core Areas and the Linkage can have substantial impact on habitat and movements of species through the Linkage Design area. It is essential to work with major land-management entities, including U.S. Forest Service, Bureau of Land Management, and County Parks to integrate the results of the linkage planning effort into their existing policies and regulations. In this report, we limit our discussion to activities in the Linkage Design area.

Mining Operations

Mining operations harm species, habitat, and ecological systems through direct impacts from the mining operation, impacts on water and air quality, impacts due to the associated infrastructure (roads, pipeline, power lines), habitat loss and fragmentation, non-native species invasions, release of pollutants, and increased motorized access (Penrod et al. 2002). All types of mining activity, from simple prospecting to the use of sluice boxes and suction dredges, can harm aquatic species. Mining alters habitat in a way that promotes the presence of harmful non-native species, for instance, suction dredging creates deeper pools, which provide habitat for nonnative predatory species such as sunfish and bullfrogs. Surface and groundwater quality can be degraded, and water quantity diminished through the direct use of water in the mining process. Mining impairs air quality through the generation of fugitive dust from blasting and crushing activities, roads, pipeline corridors, and other infrastructure disturbances. Both riparian and terrestrial habitats can be heavily impacted by mining activities (USFWS 2001).

Mining in the Linkage Design Area: Mining has a long history in Soledad Canyon, dating back to around 1860, when gold was discovered. Mining camps emerged along the river near the canyon's rich veins of silver and copper. An assortment of log cabins and tents, given the name "Soledad City," migrated up and down the canyon with each new strike. By the time the railroad came through Soledad Canyon in 1876, most of the large mines were already inactive. The existing communities of Acton and Ravenna are old mining towns that still retain their rural character.

Historically, there was also an active mine in Tick Canyon, the Sterling Borax mine (also known as the Lang Mine) that was active from 1908-1918. Colemanite was also mined through two vertical shafts, each 350 feet deep; pumping was required to keep the lower levels free of water. The mine closed in 1922, and the plant was dismantled in 1926.



susceptible to disease (Knight and Cole 1995). In addition, humans, horses and pets can carry seeds of invasive species into natural areas (Benninger 1989, Benninger-Traux et al. 1992), with potentially devastating effects.

Recreation in the Linkage Design Area: Areas currently available for recreation include the US Forest Service lands in the Core Areas, and Vasquez Rocks County Park, the Pacific Crest Trail, and several water camps along the Santa Clara River in Soledad Canyon in the Linkage Design area. The County lands contain riparian, desert scrub and juniper woodland habitats that are flanked by a growing number of homes. The County lands form a particularly critical portion of the Linkage Design area, supporting both riparian and upland species movements through an already constricted portion of the linkage. The Pacific Crest Trail is being encroached upon by rural residential development, diminishing the value of this national scenic treasure. The Linkage Design provides an opportunity to reroute the trail north of Vasquez Rocks. A number of water camps currently exist along the river in Soledad Canyon that have diverted water from the river to form pools for water play. The activities of these water camps are fairly unrestricted, further exacerbating the depletion of water resources in the river and creating unnatural habitats favored by invasive and predatory aquatic species.

Examples of Mitigation for Recreation: If recreational activities are effectively monitored, most negative impacts can be avoided or minimized by limiting types of use, directing recreational activities away from particular locations, sometimes only for particular seasons, and with reasonable precautions.

Recommendations to Mitigate the Effects of Recreation in the Linkage Design Area: We provide the following initial recommendations to prevent or mitigate negative effects of recreation in the Linkage Design area:

- Monitor trail development and recreational use to provide a baseline for decisions regarding levels, types, and timing of recreational use;
- Work with regional monitoring programs, such as the State's Resource Assessment Program, to collect information on special status species, species movements, and vegetation disturbance in areas of high recreational activity; and
- Enforce existing regulations on types of recreational use currently established.

Land Protection & Stewardship Opportunities

A variety of planning efforts addressing the conservation and use of natural resources are currently underway in the Linkage Design area. The South Coast Missing Linkages Project supports and enhances existing efforts by providing information on regional linkages critical to achieving the conservation goals of each planning effort. Since the South Coast Missing Linkages Project addresses connectivity needs for the major linkages associated with the South Coast Ecoregion, it can provide a landscape context to localized planning efforts to assist them in achieving their conservation goals. This Project is deeply committed to collaboration and coordination to achieve the vision of a wildlands network for the South Coast Ecoregion and beyond.



Heal the Bay: Founded in 1985, Heal the Bay works to make Santa Monica Bay and Southern California coastal waters safe and healthy for people and marine life. To reach their goals, they use research, education, community action and policy programs. Heal the Bay's science and policy experts engage in reviewing and commenting on countless discharge permits; testifying before the L.A. and California water quality boards on laws & enforcement; acting as a technical advisor, member, and/or leader on numerous task forces and project committees; and working with elected officials to author laws and enable projects to improve water quality. To find out more about Heal the Bay, visit them at <http://www.healthebay.org>.

Los Angeles County Aquatic Resource In-Lieu Fee Mitigation Program: The purpose of this program is to provide a voluntary alternative compensatory mitigation option that results in better designed and managed aquatic resource restoration projects. Program funds may be used for activities directly related to aquatic habitat creation, restoration, or enhancement, to include exclusively the following activities: land acquisition; purchase of easements, purchase of water rights; development of mitigation and monitoring plans; permit fees; implementation of mitigation and monitoring plans; administrative costs; and long-term management of mitigation parcels. To find out more about this program, go to <http://www.spl.usace.army.mil/regulatory/pn/200200035.pdf>.

National Park Service The purpose of the National Park Service is "...to promote and regulate the use of the...national parks...which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." The National Park Service recently secured land in the Linkage Design, along the Pacific Crest Trail, on both sides of SR-14. NPS is a partner in the South Coast Missing Linkages Project. For more on the National Park Service, see <http://www.nps.gov>.

Pacific Crest Trail Association: The mission of the Association is to protect, preserve and promote the Pacific Crest National Scenic Trail so as to reflect its world-class significance for the enjoyment, education and adventure of hikers and equestrians. The Association works to: promote the Pacific Crest National Scenic Trail as a unique educational and recreation treasure; provide a communications link among users and land management agencies; and assist the U.S. Forest Service and other agencies in the maintenance and restoration of the Pacific Crest National Scenic Trail. The Pacific Crest Trail crosses through portions of the Linkage Design and may be helpful in directing federal funds to secure land in the linkage. To find out more about the Association, visit them at <http://www.pcta.org>.

Regional Water Quality Control Board: The State WQCB strives to preserve, enhance and restore the quality of California's water resources, and ensure their proper allocation and efficient use for the benefit of present and future generations. The RWQCB oversees waters in the Linkage Design area. Mint Creek, a tributary to the Santa Clara River, is one of the first Total Maximum Daily Load (TMDL) planning efforts undertaken in the state to identify sources of pollutants and restore water quality for an impaired water body. Other impaired water body listings in the Santa Clara Watershed include the stretches of the Santa Clara River, the Santa Clara River estuary, and Bouquet Creek. For more information, visit their website at <http://www.swrcb.ca.gov>.



about environmental and planning projects in the SCV, and takes action to promote the quality of life in the Santa Clarita Valley. More information about this group can be found at their website <http://www.scope.org>.

Santa Monica Mountains Conservancy: This state agency was created by the Legislature in 1979 and is charged with the primary responsibility for acquiring land with statewide and regional significance. Through direct action, alliances, partnerships, and joint powers authorities, the Conservancy's mission is to strategically preserve, protect, restore, and enhance treasured pieces of Southern California's natural heritage to form an interlinking system of parks, open space, trails, and wildlife habitats that are easily accessible to the general public. The Conservancy manages parkland in both the Castaic (i.e., Sierra Pelona) and San Gabriel (i.e., Santa Clarita Woodlands) protected core areas. They also manage land in the surrounding ranges, in the Santa Monica Mountains, Simi Hills, and Santa Susana Mountains as part of their Rim of the Valley Trail Corridor plan. The SMMC is a partner in the South Coast Missing Linkages effort. For more information on SMMC, visit them at <http://www.smmc.ca.gov>.

Sierra Club's Santa Clara River Greenway Campaign: The stated goal of this effort is to bring the entire 500-year floodplain of the river from Fillmore to Acton into public ownership and protection. The campaign has identified a number of protection needs including water quality and quantity, plant and wildlife species habitats, movement corridors for wildlife, open space attributes and aesthetics, river fluvial dynamics, and agricultural resources. For more information on the Sierra Club's campaigns, go to <http://www.sierraclub.org>.

South Coast Wildlands: South Coast Wildlands is a non-profit group established to create a protected network of wildlands throughout the South Coast Ecoregion and is the key administrator and coordinator of the South Coast Missing Linkages Project. For all 15 priority linkages in the Ecoregion, South Coast Wildlands supports and enhances existing efforts by providing information on regional linkages critical to achieving the conservation goals of each planning effort. For more information on SCW, visit their website at <http://www.scwildlands.org>.

South Coast Missing Linkages Project: SCML is a coalition of agencies, organizations and universities committed to conserving 15 priority landscape linkages in the South Coast Ecoregion. The project is administered and coordinated by South Coast Wildlands. Partners in the South Coast Missing Linkages Project include but are not limited to: The Wildlands Conservancy, The Resources Agency California Legacy Project, California State Parks, California State Parks Foundation, United States Forest Service, National Park Service, Santa Monica Mountains Conservancy, Conservation Biology Institute, San Diego State University Field Station Programs, The Nature Conservancy, Environment Now, and the Zoological Society of San Diego Center for Reproduction of Endangered Species. For more information on this ambitious regional effort, go to http://www.scwildlands.org/pages/sc_missinglinks.php.

Southern California Wetlands Recovery Project: The Southern California Wetlands Recovery Project is a partnership of public agencies working cooperatively to acquire, restore, and enhance coastal wetlands and watersheds between Point Conception and the International border with Mexico. Using a non-regulatory approach and an ecosystem perspective, the Wetlands Project works to identify wetland acquisition and



permitting process. For more information, go to <http://www.usace.army.mil>.

US Fish and Wildlife Service: The U.S. Fish & Wildlife Service works to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people. The agency can provide support for prosecuting violations to the Endangered Species Act, law enforcement, permits, and funding for research on threatened and endangered species. USFWS has developed recovery plans for several threatened or endangered species that occur or have the potential to occur in the Linkage Design area: California condor (*Gymnogyps californianus*), arroyo toad (*Bufo microscaphus*), California red-legged frog (*Rana aurora draytonii*), California gnatcatcher (*Polioptila californica californica*), southwestern willow flycatcher (*Empidonax traillii extimus*), least Bell's vireo (*Vireo belli pusillus*), and vernal pools. The Santa Clara River is also listed as a potential recovery watershed for southern steelhead trout. The federal Endangered Species Act as amended (16 U.S.C. 1534) authorizes USFWS to acquire lands and waters for the conservation of fish, wildlife, or plants with the Land and Water Fund Act appropriations. The added protection provided by the Endangered Species Act may also be helpful for protecting habitat in the linkage from federal projects. For more information, visit their website at <http://www.fws.gov>.

US Fish and Wildlife Service Partners for Fish & Wildlife Program This program supplies funds and technical assistance to landowners who want to restore and enhance wetlands, native grasslands, and other declining habitats, to benefit threatened and endangered species, migratory birds, and other wildlife. This program may be helpful in restoring habitat on private lands in the Linkage Design. For more information on this Program, please go to <http://partners.fws.gov>.

US Forest Service: The mission of the USDA Forest Service is to sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations. The four southern California Forests (Los Padres, Angeles, San Bernardino, and Cleveland) are in the process of jointly revising their Resource Management Plans. The biological importance and feasibility of connecting the four forests to the existing network of protected lands in the region is being evaluated in the Draft Environmental Impact Statement. The USFS is allocated Land and Water Conservation Funds annually, which are designed to protect recreational open space, watershed integrity, and wildlife habitat and may be a source of funds for protecting land in the planning area. The Forest Service is taking a proactive role in habitat connectivity planning in the region as a key partner in the South Coast Missing Linkages Project. For more information, go to <http://www.fs.fed.us/r5/scfpr>.

US Geological Survey, Biological Resources Division: The Biological Resource Division (BRD) works with others to provide the scientific understanding and technologies needed to support the sound management and conservation of our Nation's biological resources. BRD develops scientific and statistically reliable methods and protocols to assess the status and trends of the Nation's biological resources. BRD utilizes tools from the biological, physical, and social sciences to understand the causes of biological and ecological trends and to predict the ecological consequences of management practices. BRD enters into partnerships with scientific collaborators to produce high-quality scientific information and partnerships with the users of scientific information to ensure this information's relevance and application to real problems.



A Scientifically Sound Plan for Conservation Action

In the South Coast Ecoregion, humans have become significant agents of biogeographic change, converting habitat to urban and agricultural uses and altering the movements of organisms, nutrients, and water through the ecosystem. The resulting fragmentation of natural landscapes threatens to impede the natural processes needed to support one of the world's greatest biological warehouses of species diversity.

This interaction among human development and unparalleled biodiversity is one of the great and potentially tragic experiments of our time. It creates a unique challenge for land managers and conservation planning efforts – to mitigate catastrophic changes to a once intact ecosystem. The conservation plan for the San Gabriel-Castaic Linkage addresses these challenges by seeking to influence regional patterns of development in a manner that best preserves landscape level processes in the Ecoregion.

The prioritization of this linkage for conservation and the demarcation of lands requiring protection in the linkage are based on the best available conservation techniques and expertise of biologists working in the region. This project provides a strong biological foundation and quantifiable, repeatable conservation design approach that can be used as the basis for successful conservation action.

Next Steps

This Linkage Design Plan acts as a scientifically sound starting point for conservation implementation and evaluation.

The plan can be used as a resource for regional land managers to understand their critical role in sustaining biodiversity and ecosystem processes, both locally and in the South Coast Ecoregion. Existing conservation investments in the linkage are already extensive including lands managed by the US Forest Service, Bureau of Land Management, County of Los Angeles, City of Santa Clarita, and other conservancy lands. Each holding lies within Core Areas or the linkage itself and serves a unique role in preserving some aspect of the connection. Incorporating relevant aspects of this plan into individual land management plans provides an opportunity to jointly implement a regional conservation strategy.

Additional conservation action will also be needed to address road, stream, urban, and industrial barriers. Recommended tools include road renovation, construction of wildlife crossings, watershed planning, habitat restoration, conservation easements, zoning, acquisition, and others. These recommendations are not exhaustive, but are meant to serve as a starting point for persons interested in becoming involved in preserving and restoring linkage function. We urge the reader keep sight of the primary goal of conserving landscape linkages to promote movement between Core Areas over broad spatial and temporal scales, and to work within this framework to develop a wide variety of restoration options for maintaining linkage function. To this end, we provided a list of organizations, agencies and regional projects that provide collaborative opportunities for implementation.



Public education and outreach is vital to the success of this effort – both to change land use activities that threaten species existence and movement in the linkage and to generate an appreciation and support of the conservation effort. Public education can encourage residents at the urban-wildland interface to become active stewards of the land and to generate a sense of place and ownership for local habitats and processes. Such voluntary cooperation is essential to preserving linkage function. The biological information, figures and tables from this plan are ready materials for interpretive programs. We have also prepared a visual journey through each linkage (Appendix C on the enclosed CD). The flyover animation consists of color aerial photographs draped over a digital elevation map.

Successful conservation efforts are reiterative, incorporating and encouraging the collection of new biological information that can increase understanding of linkage function. We strongly support the development of a monitoring and research program that addresses movement (of individuals and genes) and resource needs of species in the Linkage Design area. The suite of predictions generated by the GIS analyses conducted in this planning effort provides a starting place for designing long-term monitoring programs.

The remaining wildlands of the South Coast Ecoregion form a patchwork of natural open space within one of the world's largest metropolitan areas. Without further action, our existing protected lands will become isolated in a matrix of urban and industrial development. Ultimately the fate of the plants and animals living on these lands will be determined by the size and distribution of protected lands and surrounding development and human activities. With this linkage conservation plan, the outcome of land use changes can be altered to assure the greatest protection for our natural areas at the least cost to our human endeavors. We envision a future interconnected system of natural space where our native biodiversity can thrive.



